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NATIONAL DAM SAFETY PROGRAM. IMLAYSTOWN LAKE DAM (NJ00218), DEL--ETC(U)
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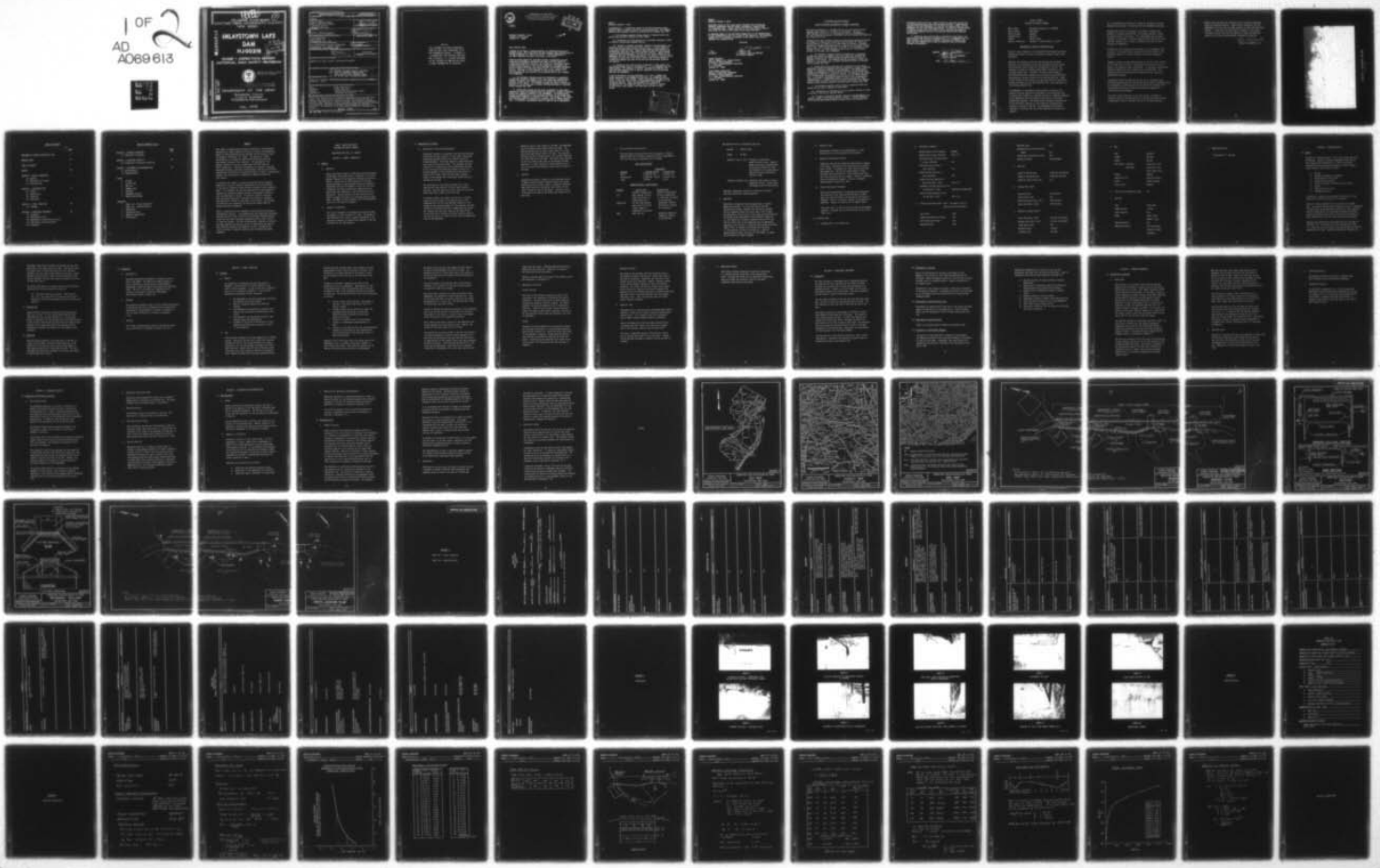

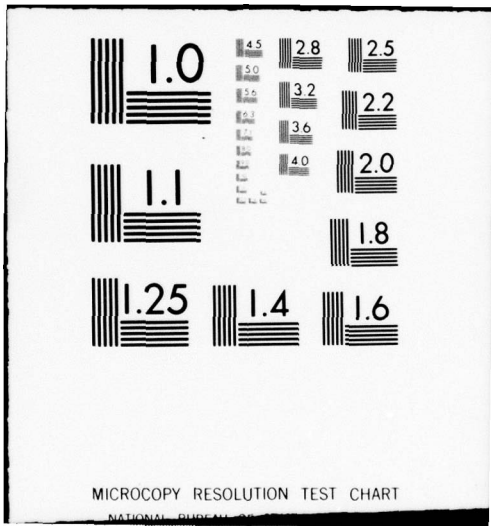
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LEVEL I

DELAWARE RIVER BASIN
DOCTORS CREEK, MONMOUTH COUNTY
NEW JERSEY

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IMLAYSTOWN LAKE DAM NJ00218

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE.

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

May, 1979

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

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Imlaystown Lake Dam
Monmouth County, N.J.

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7. AUTHOR(s): (10) Richard J. McDermott, P.E.

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Florham Park, N.J. 07932

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(6) National Dam Safety Program. Imlaystown Lake Dam (NJ00218), Delaware River Basin, Doctors Creek, Monmouth County, New Jersey. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dams
Spillways
Channel
Embankments
Bridge Construction
Visual Inspection
National Dam Inspection Act Report
Imlaystown Lake Dam, N.J.

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

24 MAY 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Imlaystown Lake Dam in Monmouth County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Imlaystown Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in poor overall condition. The dam's spillway is considered inadequate since 15 percent of the Spillway Design Flood - SDF - would overtop the dam. (The SDF, in this instance, is the 100-year Flood). To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980.

b. Within three months from the date of approval of this report, engineering studies and analyses should be performed to produce a detailed design for a complete regrading of the embankment. The design should include an investigation of the structural stability of the former mill building which comprises a section of the dam. The seepage at the former mill building should be monitored on a monthly basis by visual observation. If necessary, measurements should be made by use of appropriate

instrumentation. A topographic survey of the dam and adjacent areas should be made to provide a record of existing conditions. Any remedial measures found necessary should be initiated within calendar year 1980.

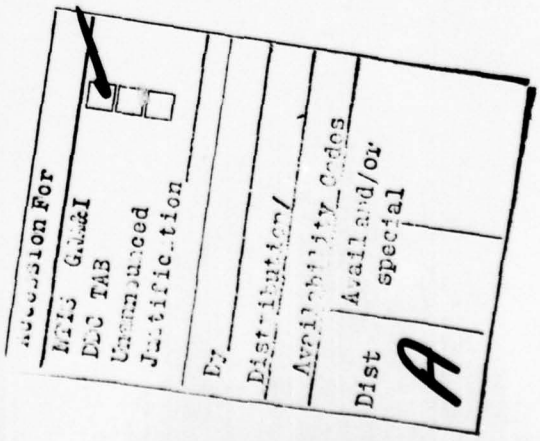
c. The following remedial actions should be completed within six months from the date of approval of this report:

(1) Reconstruct the flow barrier at the secondary spillway in order to provide a structurally adequate barrier.

(2) Initiate a program of periodic inspection and maintenance, the complete records of which should be kept on file. A visual inspection of the dam and appurtenances should be made annually and reported on a standardized check-list form. Repairs should be made when required and the following maintenance should be performed annually: remove adverse vegetation from the embankment, fill and sod any eroded surfaces of the embankment and clear the downstream channel. In addition, the lake should be lowered at least every five years at which time the lake should be cleaned and submerged portions of the dam and appurtenances inspected and repaired.

d. Within one year from the date of approval of this report, the deteriorated bridge should be reconstructed. It is recommended that the owner consider, for purposes of economy, replacing the bridge at the same time that remedial work is done in connection with the principal spillway and embankment.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Frank Thompson, Jr. of the Fourth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.



NAPEN-D
Honorable Brendan T. Byrne

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

Joel Kalkbrenner LTC

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N. J. Dept. of Environmental Protection
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Trenton, NJ 08625

John O'Dowd, Acting Chief
Bureau of Flood Plain Management
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Trenton, NJ 08625

IMLAYSTOWN LAKE DAM (NJ00218)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 7 December 1978 and 14 March 1979 by Storch Engineers under contract to the State of New Jersey. The State, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Imlaystown Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in poor overall condition. The dam's spillway is considered inadequate since 15 percent of the Spillway Design Flood - SDF - would overtop the dam. (The SDF, in this instance, is the 100-year Flood). To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980.

b. Within three months from the date of approval of this report, engineering studies and analyses should be performed to produce a detailed design for a complete regrading of the embankment. The design should include an investigation of the structural stability of the former mill building which comprises a section of the dam. The seepage at the former mill building should be monitored on a monthly basis by visual observation. If necessary, measurements should be made by use of appropriate instrumentation. A topographic survey of the dam and adjacent areas should be made to provide a record of existing conditions. Any remedial measures found necessary should be initiated within calendar year 1980.

c. The following remedial actions should be completed within six months from the date of approval of this report:

(1) Reconstruct the flow barrier at the secondary spillway in order to provide a structurally adequate barrier.

(2) Initiate a program of periodic inspection and maintenance, the complete records of which should be kept on file. A visual inspection of the dam and appurtenances should be made annually and reported on a

standardized check-list form. Repairs should be made when required and the following maintenance should be performed annually: remove adverse vegetation from the embankment, fill and sod any eroded surfaces of the embankment and clear the downstream channel. In addition, the lake should be lowered at least every five years at which time the lake should be cleaned and submerged portions of the dam and appurtenances inspected and repaired.

d. Within one year from the date of approval of this report, the deteriorated bridge should be reconstructed. It is recommended that the owner consider, for purposes of economy, replacing the bridge at the same time that remedial work is done in connection with the principal spillway and embankment.

APPROVED: Jul Kallstrom

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 24 May 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Imlaystown Lake Dam, I.D. NJ00218
State Located:	New Jersey
County Located:	Monmouth
Drainage Basin:	Delaware
Stream:	Doctors Creek
Dates of Inspection:	December 7, 1978 and March 14, 1979

Assessment of General Condition of Dam

Based on visual inspection, past operational performance and Phase I engineering analyses, the dam is assessed as being in poor overall condition.

Hydraulic and hydrologic analyses indicate that the principal spillway is not sufficient to pass the designated spillway design flood (100-year storm) without an overtopping of the dam. The spillway is capable of passing approximately 14 percent of the spillway design flood. Therefore, the owners should engage a qualified professional engineer soon to perform accurate hydraulic and hydrologic analyses relating to the spillway capacity. Based on the findings of the analyses, the spillway should be modified to prevent overtopping of the dam resulting from a storm equivalent to the spillway design flood.

The embankment is considerably deteriorated by erosion on the upstream side and cracking and settlement on the downstream side. To correct this condition, a detailed design for a complete regrading of the embankment should be prepared very soon by a qualified professional engineer. The design should include an investigation of the structural stability of the former mill building which comprises a section of the dam. The embankment should then be regraded in accordance with the design immediately following its approval.

It is recommended that measures to remedy the inadequate spillway condition be performed in connection with the embankment regrading.

Although the bridge is considered to be stable at present, the concrete is severely deteriorated. The bridge, therefore, should be reconstructed in the future. It is recommended that the owner consider, for purposes of economy, replacing the bridge at the same time that remedial work is done in connection with the principal spillway and embankment.

In addition to the measures outlined above, it is recommended that the owner, in the near future, reconstruct the flow barrier at the secondary spillway in order to provide a structurally adequate barrier.

Seepage is present in the downstream area of the dam in the vicinity of the former mill building. Arrangements should be made soon to monitor the seepage by visual observation. If necessary, measurements should be made by the use of appropriate instrumentation. The monitoring should be performed on a monthly basis by a qualified professional engineer.

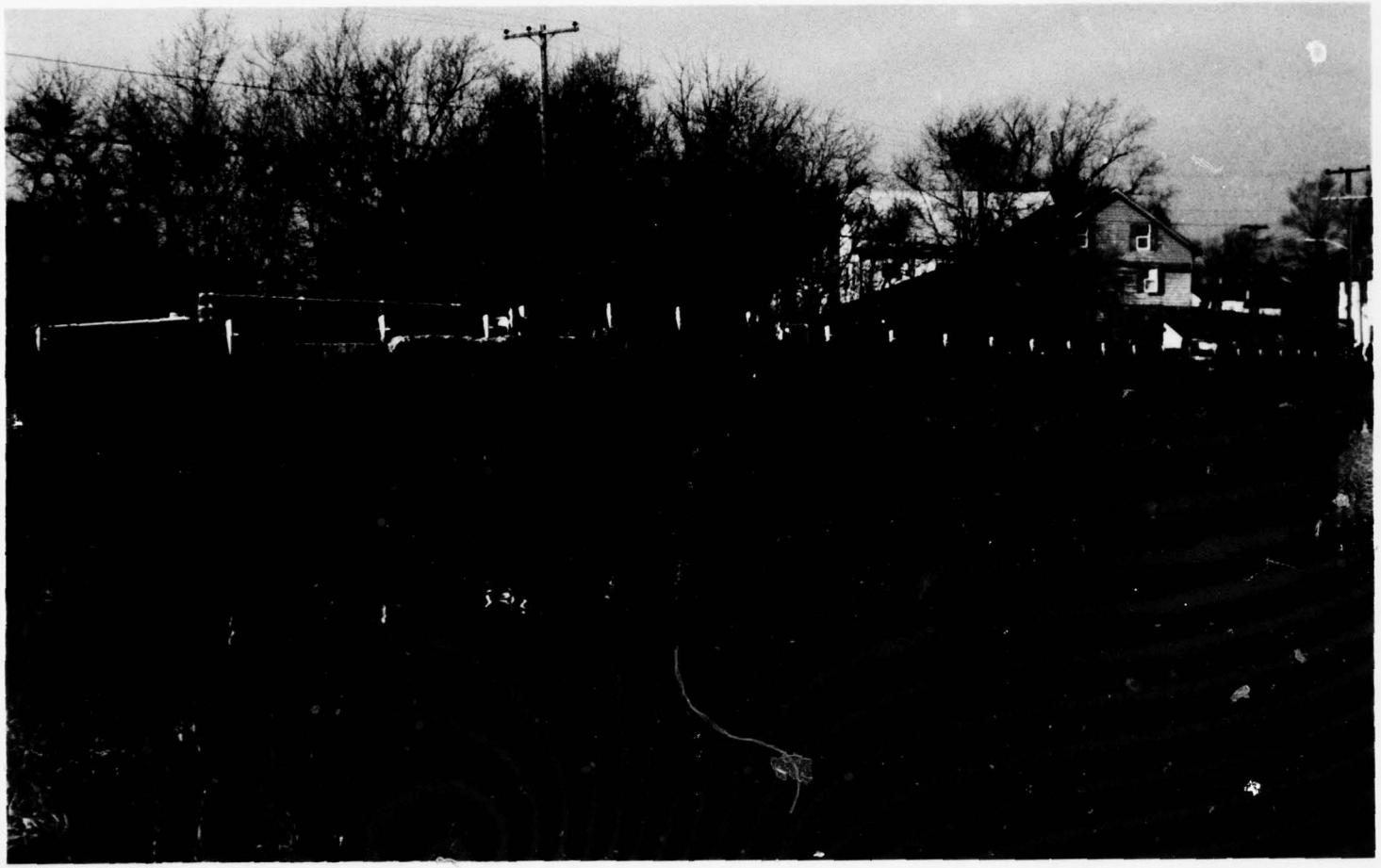
Arrangements should be made very soon to form an agreement among the three apparent owners of the dam that would specify responsibilities for maintenance, record keeping and cost sharing for remedial work. The agreement should also specify any necessary easements for construction and maintenance.

The owners should implement, in the near future, a program of periodic inspection and maintenance for the dam which would include a topographic survey to provide a record of existing conditions.

Repairs should be made when required and the following maintenance should be performed annually: remove adverse vegetation from the embankment, fill and sod any eroded surfaces and clear the downstream channel. In addition, the lake should be lowered at least every five years at which time the lake should be cleaned and submerged portions of the dam and appurtenances inspected and repaired.

Richard J. McDermott

Richard J. McDermott, P.E.



OVERVIEW - IMLAYSTOWN LAKE DAM

7 DEC. 1978

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 30214. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that the unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

IMLAYSTOWN LAKE DAM, I.D. NJ00218

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers to initiate a National Program of Dam Inspection throughout the United States. The Division of Water Resources of the New Jersey Department of Environmental Protection (NJDEP) in cooperation with the Philadelphia District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams withing the State of New Jersey. Storch Engineers has been retained by the NJDEP to inspect and report on a selected group of these dams. The NJDEP is under agreement with the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspections of Imlaystown Lake Dam were made on December 7, 1978, and March 14, 1979. The purpose of the inspections was to make a general assessment of the structural integrity and operational adequacy of the dam structure and its appurtenances.

1.2 Description of Project

a. Description of Dam and Appurtenances

Imlaystown Lake Dam is an earthfill dam with two spillways. The primary spillway consists of five timber slide gates discharging through the dam via a channel formed by bridge abutments. The bridge supports a paved road which runs along the entire dam crest. The secondary spillway consists of a concrete arch culvert penetrating the dam at its north end and outflowing through a former mill. A concrete headwall at the upstream end of the culvert is fitted with a timber trash rack and timber sheeting which, at the present time, effectively blocks most flow through the spillway.

The slide gates of the primary spillway form a free overflow weir when they are in their normal downward position. When the gates are raised, they form an outlet works which can be used to drain the lake.

A concrete corewall and timber cut-off wall is located along the entire length of the upstream side of the embankment and ties into the upstream wingwalls of the bridge and the upstream headwall of the secondary spillway. Sections of the downstream face of embankment are formed by a masonry wall and steel sheet piling respectively. At the north end of the dam a building formerly used as a mill and now used as an office is built into the downstream side of the embankment.

Having an overall crest length of 350 feet, the embankment has a top width varying from 35 feet to 50 feet. The primary spillway has an overall crest length of 17 feet and a discharge channel width of 24 feet. The secondary spillway, having no discharge weir, has culvert dimensions of 5 feet high by 10 feet wide. The outlet works consists of the five timber slide gates of the primary spillway. Each gate is 4 feet long and is raised manually by the use of a slotted stem extending upward from the center of the gate.

b. Location

Imlaystown Lake Dam is located in the Imlaystown section of Upper Freehod Township, Monmouth County, New Jersey. Constructed across Doctors Creek, it impounds Imlaystown Lake which forms the recreational focal point for the small residential area of Imlaystown. Principal access to the dam is provided by the county road located on the dam crest.

c. Size and Hazard Classification

Size and Hazard Classification criteria presented in "Recommended Guidelines for Safety Inspection of Dams", published by the U.S. Army Corps of Engineers are as follows:

SIZE CLASSIFICATION

	Impoundment	
Category	Storage (Ac-ft)	Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (no permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture)
Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than few	Excessive (Extensive community, industry or agriculture)

The characteristics of Imlaystown Lake are:

Storage = 188 acre-feet

Height = 20 feet

Potential Loss of Life: No homes in flood plain within 4 miles of dam. Several homes and business establishments in low lying portions of lake at Allentown 4 miles downstream of dam not seriously affected by failure of dam.

Potential Economic Loss: Secondary road bridge 1.4 miles downstream of dam. Bridge could be washed out by failure outflow.

Therefore, Imlaystown Lake Dam is classified as "Small" size and "Significant" hazard potential.

d. Ownership

Ownership of Imlaystown Lake Dam apparently is divided among three parties. 1.) The south end of the dam, including the bridge, together with the entire upstream face of embankment below the normal water line is owned and operated by the Division of Fish, Game and Shellfisheries of the New Jersey Department of Environmental Protection. 2.) The former mill building, together with the mill race and 110 linear feet of the downstream face of embankment adjacent to the building is owned by Zion & Breen Associates, whose office is located in the former mill building. 3.) The northern 130 feet of the dam for a width of approximately 29 feet, exclusive of side slopes, is owned by the Township of Upper Freehold.

e. Purpose of Dam

The purpose of the dam is the impoundment of a lake faclity used for fire protection and recreation.

f. Design and Contruction History

Imlaystown Lake Dam was originally constructed to impound a mill pond. The date of this construction was probably prior to 1900. On December 19, 1922, the dam and bridge were washed out. The dam was reconstructed in 1924, including the construction of a new bridge and spillway and a new culvert at the mill intake. Plans for reconstruction were prepared by George K. Allen Jr., Monmouth County Engineer, dated July, 1923.

g. Normal Operational Procedures

The dam and appurtenances are operated and maintained by the Division of Fish, Game and Shellfisheries, NJDEP, while the road and bridge is maintained by the County of Monmouth. There is no regular schedule of maintenance or operation. Repairs are made on an "as needed" basis.

The outlet works is used to drain the lake for maintenance purposes. The gates are not raised during times of high water level.

1.3 Pertinent Data

a. Drainage Area = 8.8 square miles

b. Discharge at Damsite

Maximum known flood at damsite	Unknown
Outlet works at pool elevation	208 c.f.s.
Diversion tunnel low pool outlet at pool elevation	N.A.
Diversion tunnel outlet at pool elevation	N.A.
Gated spillway capacity to pool elevation	N.A.
Primary spillway capacity at top of dam (elev. 50.0)	591 c.f.s.
Secondary spillway capacity at top of dam (elev. 50.0)	Negligible (bulkheaded)
Total spillway capacity at top of dam (elev. 50.0)	591 c.f.s.

c. Elevation (Assumed datum) Note: For approx. N.G.V.D. add 61.0 to all elevations.

Top of Dam	50.0
Maximum pool-design surcharge	52.9
Full flood control pool	N.A.
Recreation pool	44.8

Spillway crest	44.5
Upstream portal invert diversion tunnel	N.A.
Stream bed at centerline of dam	32.5
Maximum tailwater	40 (Estimated)

d. Reservoir

Length of Maximum pool	5,000 feet (Estimated)
Length of recreation pool	2,700 feet (scaled)
Length of flood control pool	N.A.

e. Storage (Acre-feet)

Recreation pool	36 acre-feet
Flood control pool	N.A.
Design surcharge (Elev. 52.9)	344 acre-feet
Top of dam (Elev. 50.00)	188 acre-feet

f. Reservoir Surface (Acres)

Top of Dam (Elev. 50.0)	46 acres (Estimated)
Maximum pool (Elev. 52.9)	67 acres (Estimated)
Flood control pool	N.A.
Recreation pool	18 acres
Spillway crest	18 acres

g. Dam

Type	Earthfill
Length	350 feet
Height	20 feet
Side slopes - Upstream	2 horiz to 1 vert.
Downstream	Masonry wall and steel sheet piling
Zoning	Unknown
Impervious core	Concrete Corewall
Cutoff	Timber sheeting
Grout curtain	Unknown

h. Diversion and Regulating Tunnel — N.A.

i. Spillway

Type	Slide Gates
Length of weir	17 feet
Crest elevation	44.5
Gates	Timber Slide Gates-4' long
Upstream Channel	N.A.
Downstream Channel	24' wide Channel formed by bridge abutments

j. Regulating Outlets

5 slide gates, 4' long each

SECTION 2: ENGINEERING DATA

2.1 Design

No plans or calculations pertaining to the original dam could be obtained. However, information generated at the time of the bridge and dam reconstruction in 1924 is available. Construction drawings prepared by George K. Allen, Monmouth County Engineer, contain the following:

a. Key map
b. Proposed arangement of cofferdams
c. Bridge abutment footing plan
d. Bridge plan and sections
e. Culvert (secondary spillway) plan and section
f. Details
g. Plan and profile of dam
h. Embankment sections

In addition, a subdivision plat showing the outline of land owned by Zion and Breen Associates is available.

Structural design computations are available in the NJDEP file. A structural design report prepared by the N. J. Department of Conservation and Development dated March 11, 1924 indicates that the bridge design was considered satisfactory provided certain modiciations were made in the design of the wingwalls. These modifications were later made and the design approved.

Hydraulic and hydrologic design computations are available in the NJDEP file. The design inflow was computed to be 1500 c.f.s. based on the South Jersey Curve and the Gage at Allentown, downstream of the dam. Hydraulic computations indicated that

the design flood could be passed by discharge over the five gates with a lake stage rise of 4.0 feet. This would result in a water level 1.5 feet above the top of the core wall. Therefore, to avoid water levels above the core wall, it was decided to make the top 1.5 feet of the slide gates in the form of removable stoplogs which would be removed at the time of high flood levels.

Two borings were made at the bridge location during 1923 and indicated the following subsurface conditions:

17' - 20' below elevation of stream: "hard strata"
20' - 39': "Very hard strata of sand and clay or marl"
Subsurface stream flowing through the strata of hard sand and marl.

2.2 Construction

Several progress reports were prepared during construction activities in 1924. A final report, dated June 18, 1925, indicated that work had been completed in a satisfactory manner in accordance with the approved plans and specifications. In this report, flow through two weep holes and through a boil adjacent to the downstream wingwall was reported but not considered to endanger the stability of the bridge and dam structure.

2.3 Operation

The only record pertaining to the operation of the dam is a letter from the NJDEP, Division of Water Resources to the Division of Fish, Game and Shellfisheries dated August 3, 1971, granting permission to draw down the lake. The lake reportedly was drawn down subsequent to that date and allowed to remain empty for one year.

2.4 Evaluation

a. Availability

Available engineering information is limited to that on file at the NJDEP. The NJDEP file contains copies of plans, calculations, design reports, correspondence, photographs, inspection reports and construction specifications. The file is available for inspection at the offices of the Bureau of Flood Plain Management, 1474 Prospect Street, Trenton, N.J.

b. Adequacy

The available information forms a fairly complete description of the subject dam and is considered to be of significant assistance in the performance of a Phase I evaluation. A list of absent information is included in paragraph 7.1.b.

c. Validity

All of that information that could be verified was found to be valid within a reasonable allowance for error.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The inspection of Imlaystown Lake Dam took place on December 7, 1978 and March 14, 1979 by members of the staff of Storch Engineers. A copy of the visual inspection check list is contained in Appendix 1. The following procedures were employed for the inspection:

1. The embankment of the dam, appurtenant structures and adjacent areas were examined.
2. Areas of suspected seepage were noted and located.
3. The embankment and appurtenant structures were measured and key elevations determined by hand level.
4. The embankment and appurtenant structures and adjacent areas were photographed.
5. A member of the staff of the Division of Fish, Game and Shellfisheries was present to assist in the inspection.

b. Dam

The horizontal alignment of the dam appeared to be slightly curved. Vertically, the dam crest varied from a maximum elevation of 52.5 at the primary spillway to a minimum elevation of 50.0 at the secondary spillway at the north end of the dam. Beyond the north end of the dam, ground elevations rise, thus, forming a low point at elevation 50.0. Beyond the south end of the dam, ground elevations

decrease and then increase again, thus forming a low area approximately 50 feet south of the end of the dam. This low area has a minimum elevation of 50.0 which is equal to the elevation of the low area at the north end of the dam.

Evidence of structural instability was noted on the downstream side of the embankment. Approximately 30 feet of the masonry wall along the downstream face of dam has collapsed and some of the embankment material has sloughed in that area. The remaining 60 feet of wall has deteriorated as follows:

a. Several cracks, mostly vertical, have formed in the wall. The cracks range from 1 inch to 3 inches in width.
b. A large vertical crack, one foot in width, has developed during the winter of 1978-1979. Stones have been displaced from the space formed by the crack.
c. The wall is leaning so that its top extends farther in a downstream direction than its base.
d. The wall, at its junction with the north downstream wingwall of the bridge has been undermined by the scouring effect of the high water level in the stilling basin.

Adjacent to and on the west side of the paved road on the embankment crest, is located a bituminous sidewalk in which cracks have formed. The cracks are parallel to the dam and indicate possible shearing of the embankment.

30

The paved road on the dam crest appears to have settled in areas of the embankment north of the bridge. Two adjacent sections of a storm water pipe in the north end of the dam have become mis-aligned indicating movement of the embankment.

The entire length of the upstream face of the dam has suffered loss of material so that the concrete corewall is exposed for that entire length .

Brush and trees in addition to grass are growing on the embankment, and especially on the downstream face. Some of the trees have been cut leaving stumps with new shoots approximately 2 to 3 years old. The upstream face of dam is mainly grass and brush covered.

A point of seepage was observed downstream of the downstream toe of the dam and adjacent to the former mill building. Discharging in the form of a slight trickle, the seepage flows into the mill race beneath the building.

Steel sheet piling along a section of the downstream face of dam appeared to be structurally sound. However, the surface of the steel sheet piling is rusted.

The generalized soils description of the dam site consists of stratified deposits of marine origin composed of silt and silty clay overlying silty sand and clay referred to as Navesink Marl on the Geologic Map of New Jersey prepared by Lewis and Kummel. Overlying the Navesink Marl in some areas are unconsolidated, stratified alluvial depostis, consisting of interbedded silt, silty sand, and silty and

clayey sand and gravel. Recently deposited alluvium is found along the stream bed. Bedrock is in excess of 100 feet below the ground surface.

Reports of borings made in the area of the bridge in 1923 are summarized in paragraph 2.1.

c. Appurtenant Structures

Primary Spillway

The crest of the spillway, formed by the tops of the slide gates, was submerged by overflow at the time of inspection. The gates could not be directly observed, although they appeared uniformly aligned. The timber supports for the gates appeared to be in satisfactory condition. Three of the five gate lifting stems were broken off rendering those gates inoperable. Neither of the two remaining intact gates was operated at the time of inspection.

Bridge

Although the bridge appeared to be structurally stable, all concrete surfaces were in a deteriorated condition - some surfaces severely so. Cracks and spalls were noted in the abutments, wingwalls, bridge beams and decking. Some leaching of concrete was observed at cracks and joints. Deterioration was generally most severe in the area of water line fluctuations and tops and sides of wingwalls.

Secondary Spillway

The intake to the secondary spillway discharge culvert was blocked by timber sheeting and a timber trash rack at the time of inspection. Therefore, the condition of the culvert could not be observed. However, concrete surfaces of the culvert headwall appeared to be in satisfactory condition. The timber flow barrier fitted at the intake to the culvert was leaking at the time of inspecton and appeared unable to withstand hydrostatic pressures associated with water levels significantly higher than the roadway (elevation 50.0). Thus, the sheeting could fail under severe flooding conditions.

d. Revervoir Area

Imlaystown Lake is long and narrow, averaging approximately 290 feet in width with an overall length of approximately one-half mile. It is located in the small residential area of Upper Freehold Township known as Imlaystown.

Terrain surrounding the lake has slopes ranging from 2% to greater than 15%. Most of the shoreline is wooded with a few buildings located along the south shore.

The lake is reportedly severely silted and as a result has an average water depth of one to two feet. Probing at the spillway indicated a minimum of one to two feet of sediment.

e. Downstream Channel

The primary spillway discharges into Doctors Creek which is a shallow winding stream with a wide swampy flood plain. Although the stream has no significant obstructions, some tree growth was observed in the stilling basin immediately downstream of the bridge.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The level of water in Imlaystown Lake is regulated naturally by discharge over the slide gates of the primary spillway. The gates are normally left in place and thus operate as an uncontrolled weir. However, two of the gates can be raised and thereby operate as an outlet works. The gates reportedly are not raised at times of high water levels.

The most recent drawdown of the lake was performed eight years ago. At that time the lake remained empty for one year. The time required to lower the lake at that time was one to two days.

The primary spillway was constructed in 1924 with 1.5-foot high stoplogs fitted above the slide gates. The operating weir crest elevation was 46.0. In 1978, the stoplogs were removed after high water levels overtopped the dam at its north end as well as the low area to the south. The operating weir crest elevation then became 44.5 at which it has been maintained to the present time. Reportedly, the overtopping in 1978 resulted in no significant damage.

The flow barrier at the secondary spillway is left in place continuously. Therefore, the secondary spillway serves no operational purpose at the present time.

4.2 Maintenance of the Dam

Most of the maintenance of the dam is performed by staff members of the Division of Fish, Game and Shellfisheries of the NJDEP. Normal maintenance consists of clearing the principal spillway inlet of accumulated debris. Repairs are made on an "as needed" basis.

Maintenance of the bridge and roadway is under the jurisdiction of the County of Monmouth. Maintenance and repairs are performed on an "as needed" basis and normally consist of patching the roadway pavement.

4.3 Maintenance of Operating Facilities

Maintenance of operating facilities such as the primary spillway gates is performed on an "as needed" basis. The most recent repair was the replacement of the lift gates about eight years ago.

4.4 Description of Warning System

There is no warning system in effect at the present time.

4.5 Evaluation of Operational Adequacy

The dam has not been operated as intended by the designers. The stoplogs installed at that time were intended to be removed at times of high water. Reportedly, they were normally not removed and this practice resulted in the overtopping of the dam in 1978.

Maintenance documentation for the dam is poor and the maintenance performed since 1924 has also been poor. Areas of maintenance that have not been adequately performed are:

1. Concrete surfaces of bridge allowed to severely deteriorate.
2. Masonry wall on downstream side of dam allowed to severely deteriorate and partially collapse.
3. Upstream face of embankment allowed to severely erode.
4. Roadway allowed to crack and settle.
5. Embankment allowed to slough on the downstream side.
6. Trees and brush allowed to grow on the embankment.
7. Steel sheet piling allowed to rust.
8. Gate stems on three of the lift gates of the primary spillway not replaced.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The intensity of storm water runoff that the spillway should be able to handle is based on the size and hazard classification of the dam. This runoff intensity, called the spillway design flood (SDF), is described in terms of return frequency or probable maximum flood (PMF) depending on the extent of the dam's size and potential hazard. According to the "Recommended Gudielines for Safety Inspection of Dams", published by the U.S. Army Corps of Engineers, the SDF for Imlaystown Lake Dam falls in a range of 100-year frequency to 1/2PMF. In this case, the low end of the range, 100-year frequency, is chosen since the factors used to select size and hazard classification are on the low side of their respective ranges.

The peak SDF computed for Imlaystown Lake Dam is 4244 c.f.s. This value is derived from the 100-year hydrograph computed by the use of the Soil Conservation Service (SCS) unit hydrograph in the HEC-1-DB Flood Hydrograph Computer Program. Detailed hydrologic computations and computer output are contained in Appendix 4.

The dam crest elevation varies from 50.0 at the north end of the secondary spillway to 52.5 at the south end at the primary spillway and bridge. See profile in Appendix 4. For overtopping analysis, the dam crest elevation was assumed to be 50.0. (Note: top of dam was assigned elevation 52.4 in the HEC-1-DB program to facilitate input of data.)

When the lake level rises higher than elevation 50.0, discharge from the lake will occur from two points in addition to the spillway. Water will flow over the dam at its low point in the vicinity of the secondary spillway and water will flow over a low area (elevation 50.0) south of the south end of the dam. These two points of discharge from the lake were assumed to have characteristics of a broad crested weir with C=2.63.

The spillway was assumed to have characteristics of a sharp crested weir for water levels up to the bottom of the bridge and to have characteristics of an orifice for water levels higher than the bottom of the bridge.

The discharge capacity of the spillway with water level equal to the crest of dam (elevation 50.0) was computed to be 591 c.f.s. A routing of the SDF through Imlaystown Lake resulted in an overtopping of the dam crest by a depth of 2.9 feet (water level elevation 52.9). Accordingly, the subject spillway is assessed as being inadequate in accordance with criteria developed by the U.S. Army Corps of Engineers.

b. Experience Data

Reportedly, Imlaystown Lake Dam was overtopped in January 1978. At that time, high water levels flowed over the dam in the vicinity of the secondary spillway and mill and also discharged from the lake at the low area south of the dam. Apparently, no significant damage was done at that time.

c. Visual Observations

No evidence was found at the time of inspection that would indicate that the dam had been overtopped.

d. Overtopping Potential

As indicated in paragraph 5.1.a, a storm of magnitude equivalent to the SDF would cause overtopping of the dam by a height of 2.9 feet above the crest (elevation 52.9). The spillway is capable of passing approximately 14 percent of the SDF with lake level equal to the crest of dam (elevation 50.0).

40

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The embankment appeared, at the time of inspection, to exhibit significant structural distress on portions of its downstream side. Cracks in the road pavement along the downstream side and considerable deterioration of the masonry wall along part of the downstream face of embankment were observed. In addition, some settlement of the roadway on the downstream side of the dam was noted.

The bridge, although severely spalled, appeared to be structurally stable with no evidence of significant movement or distress.

The upstream side of the embankment also appeared structurally stable, despite severe erosion causing the concrete core wall to be exposed. No differential settlement of the core wall was observed.

The substantial width of dam together with the stability of the bridge indicates that the distress observed in the downstream side does not pose an immediate threat to the overall structural stability of the dam. However, the existing condition of distress will become serious if corrective measures are not implemented.

An accurate determination of the severity of the seepage depends on several factors, one of which is periodic observation. The severity of the seepage noted at Imlaystown Lake Dam cannot be precisely determined at the present time.

b. Design and Construction Data

Structural design computations as well as a structural design report is available in the NJDEP file. The report indicates that the bridge design is satisfactory.

c. Operating Records

No operating records are available for the dam. The water level of Imlaystown Lake is not monitored.

d. Post Construction Changes

Since Imlaystown Lake Dam was reconstructed in 1924 the following changes have taken place: 1) a flow barrier was installed at the intake of the secondary spillway and 2) the 1.5-foot high stoplogs were removed from the lift gates causing the normal lake level to fall by 1.5 feet.

e. Seismic Stability

Imlaystown Lake Dam is located in seismic Zone 1 as defined in "Recommended Guidelines for Safety Inspection of Dams" which is a zone of very low seismic activity. Experience indicates that dams in Seismic Zone 1 will have adequate stability under seismic loading conditions if stable under static loading conditions. Imlaystown Lake Dam exhibits distress in the downstream side of its embankment but is not considered imminently unstable under static loading conditions.

SECTION 7: ASSESSMENT AND RECOMMENDATIONS

7.1 Dam Assessment

a. Safety

Based on hydraulic and hydrologic analyses outlined in Section 5 and Appendix 4, the spillway of Imlaystown Lake Dam is considered inadequate. The spillway is not able to pass the SDF designated for the dam without an overtopping of the dam.

The dam embankment exhibits distress and instability on a portion of its downstream side. However, because of its substantial width and the stability of the bridge structure the overall embankment is not imminently unstable.

b. Adequacy of Information

Information sources for this study include: 1) field inspections, 2) plans, reports and correspondence in NJDEP files, 3) USGS quadrangle, 4) aerial photography from Monmouth County and 5) consultation with personnel of the Division of Fish, Game and Shellfisheries, NJDEP. The information obtained is sufficient to allow a Phase I assessment as outlined in "Recommended Guidelines for Safety Inspection of Dams."

Some data not available are as follows:

1. Stream and lake elevation gauging records.
2. Description of dam embankment fill materials.
3. Inspection reports subsequent to construction.

c. Necessity for Additional Data/Evaluation

Additional evaluation is considered necessary in order to assess the effect of the observed seepage on the structural integrity of the dam. The evaluation should be based on monitoring of seepage as outlined in paragraph 7.2.c.

To provide an adequate record of existing conditions at the dam, a topographic survey should be undertaken as outlined in paragraph 7.2.c.

7.2 Recommendations

a. Remedial Measures

Based on hydraulic and hydrologic analyses outlined in paragraph 5.1.a, the spillway is considered to be inadequate. It is therefore recommended that a qualified professional engineer be engaged soon to perform more accurate hydraulic and hydrologic analyses relating to the spillway capacity. The analyses should more accurately determine runoff characteristics of the watershed and should refine the discharge capacity of the spillway and the downstream channel capacity. Based on the findings of these analyses, the dam and spillway should be modified to prevent overtopping of the dam resulting from a storm equivalent to the SDF. The Division of Fish, Game and Shellfisheries has, in 1971, expressed the intention to replace the spillway.

The embankment is considerably deteriorated by erosion on the upstream side and cracking and settlement on the downstream side. To correct this condition, a detailed design for a complete regrading of the embankment should be prepared very soon by a qualified professional engineer and the embankment regraded accordingly. The regrading

operation should be implemented immediately following approval of the design. The design should include an investigation of the structural stability of the former mill building now occupied by Zion and Breen Associates. Such an investigation is considered necessary in order to completely assess the structural stability of the dam.

It is recommended that measures to remedy the inadequate spillway condition be performed in connection with the embankment regrading.

Although the bridge is considered to be stable at present, the concrete is severely deteriorated. The bridge, therefore, should be reconstructed in the future. It is recommended that the owner consider, for purposes of economy, replacing the bridge at the same time that remedial work is done in connection with the principal spillway and embankment.

In addition to the measures outlined above, it is recommended that the owner, in the near future, reconstruct the flow barrier at the secondary spillway in order to provide a structurally adequate barrier.

The implementation of each of the above remedial measures will require proper detailed studies and design as well as the obtaining of applicable NJDEP approvals.

b. Maintenance

The owners of the dam should initiate, in the near future, a program of periodic inspection and maintenance, the complete records of which to be kept on file and made

available to the public. A visual inspection of the dam and appurtenances by a qualified professional engineer should be made annually and reported on a standardized check-list form. Repairs should be made when required and the following maintenance should be performed annually: remove adverse vegetation from the embankment, fill and sod any eroded surfaces of the embankment and clear the downstream channel. In addition, the lake should be lowered at least every five years at which time the lake should be cleaned and submerged portions of the dam and appurtenances inspected and repaired.

c. Additional Studies

Arrangements should be made very soon to form an agreement among the three apparent owners of the dam that would specify responsibilities for maintenance, record keeping and cost sharing for remedial work. The agreement should also specify any necessary easements for construction and maintenance.

Arrangements should be made soon to monitor the seepage by visual observation. If necessary, measurements should be made by the use of appropriate instrumentation. The monitoring should be performed on a monthly basis by a qualified professional engineer and included in the permanent records mentioned in paragraph 7.2.b.

A detailed topographic survey of the dam and the areas around the dam should be undertaken soon by a qualified licensed land surveyor or professional engineer. The survey should be related to existing construction drawings and should become part of the permanent records of the dam mentioned in paragraph 7.2.b.

PLATES

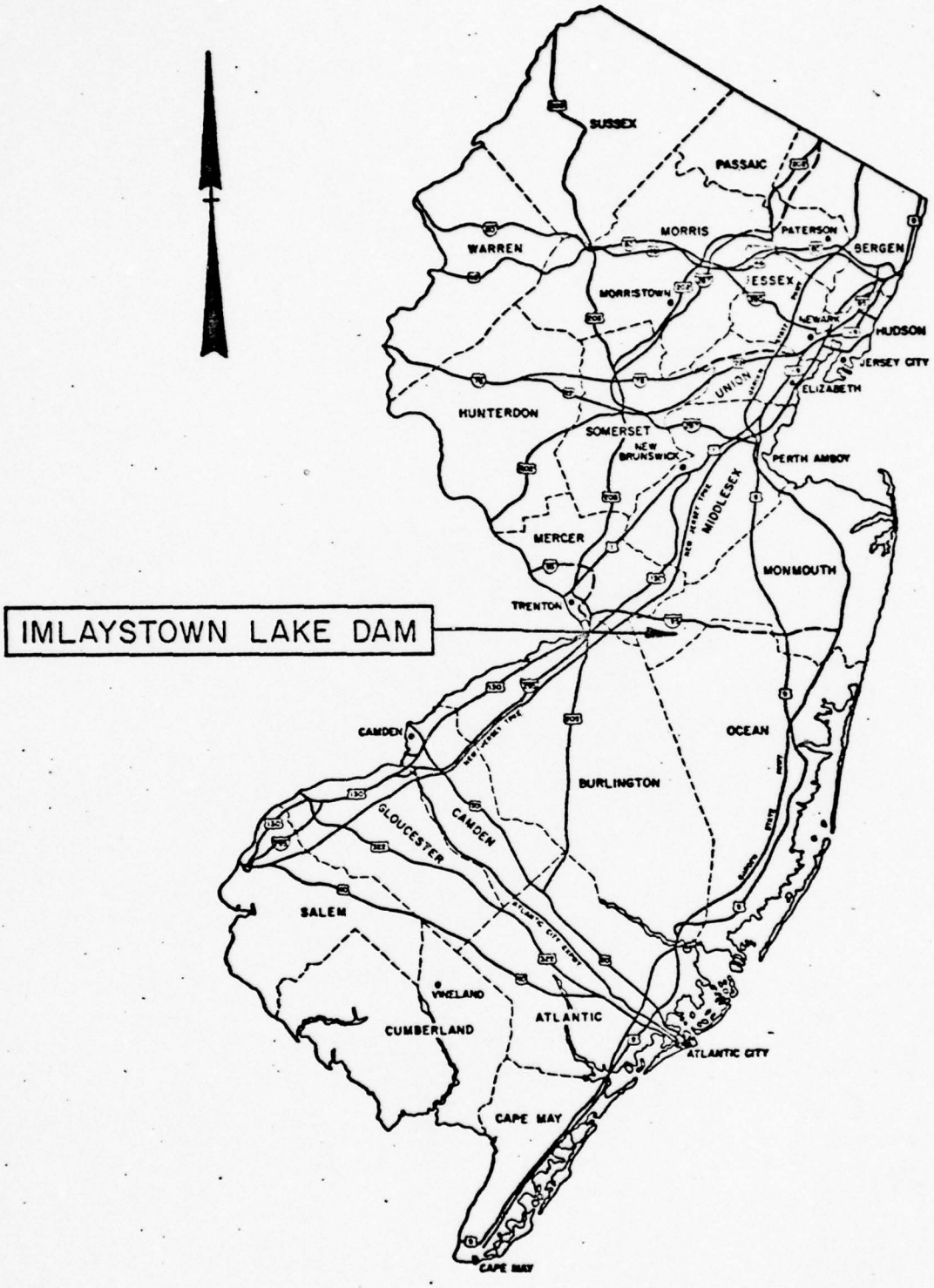


PLATE 1

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

KEY MAP

IMLAYSTOWN LAKE DAM

I.D. N.J. 00218

SCALE: NONE

DATE: MARCH, 1979

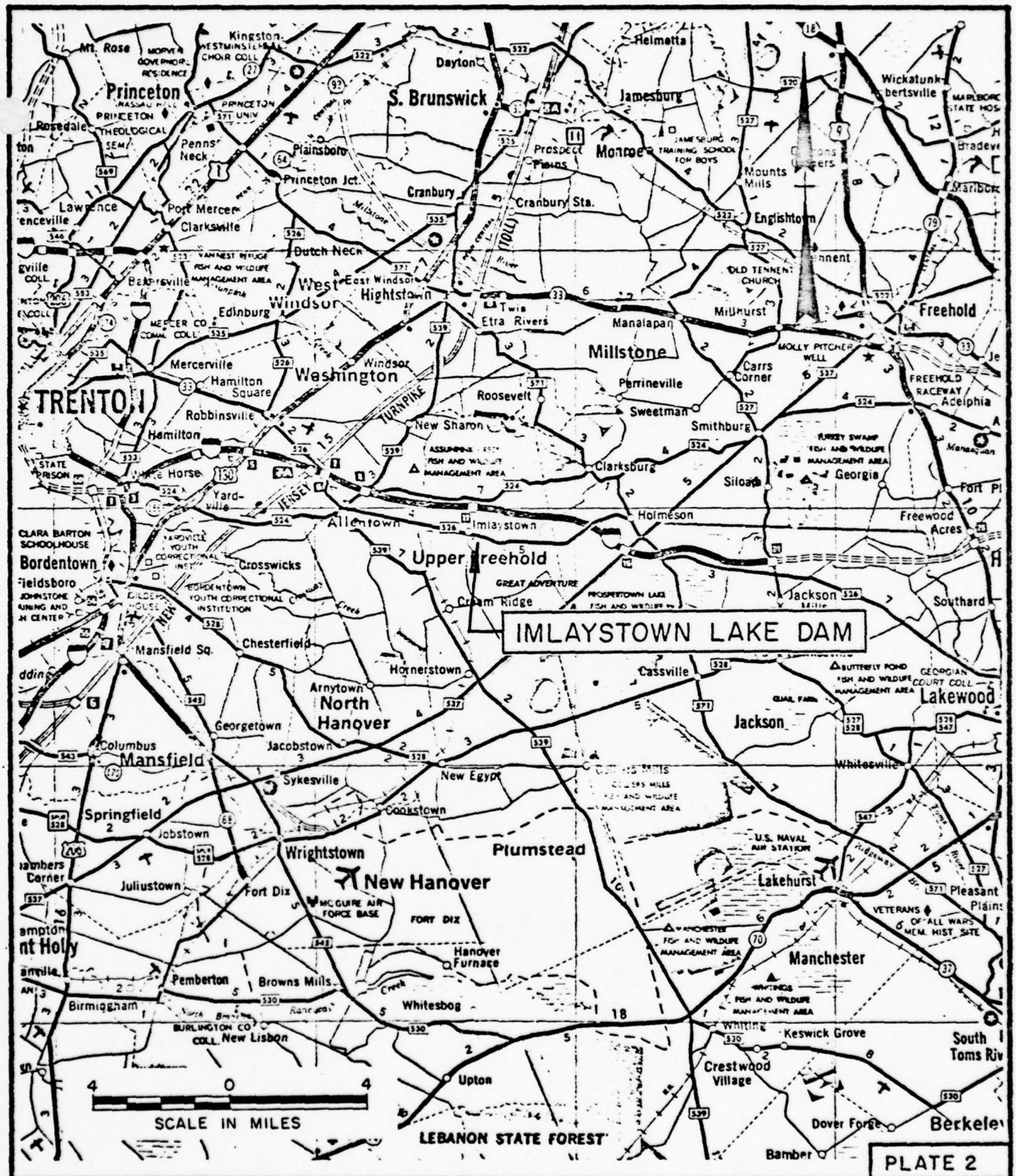


PLATE 2

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

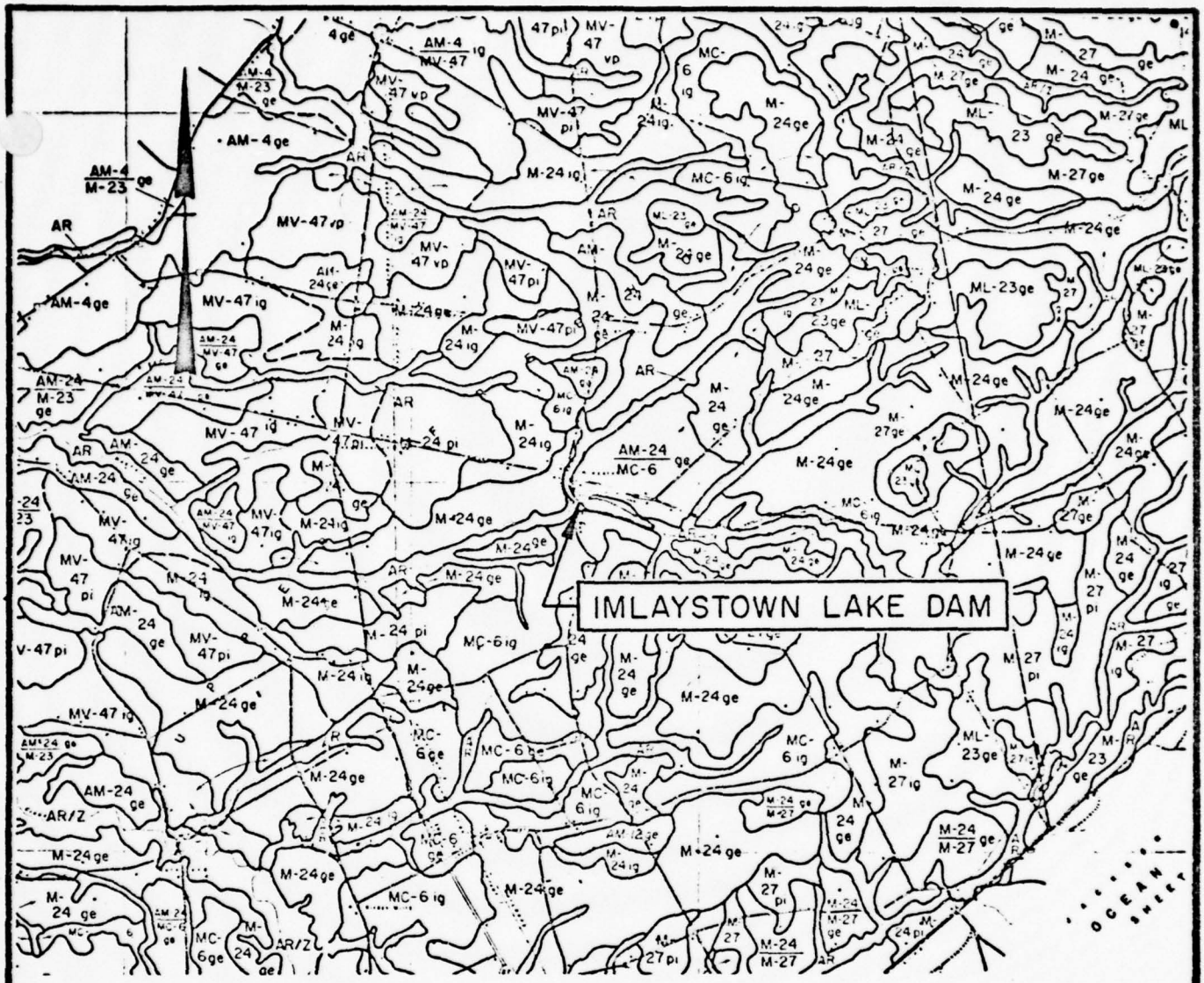
VICINITY MAP

IMLAYSTOWN LAKE DAM

I.D. N.J. 00218

SCALE: AS SHOWN

DATE: MARCH, 1979



Legend

AR — Recently deposited alluvium

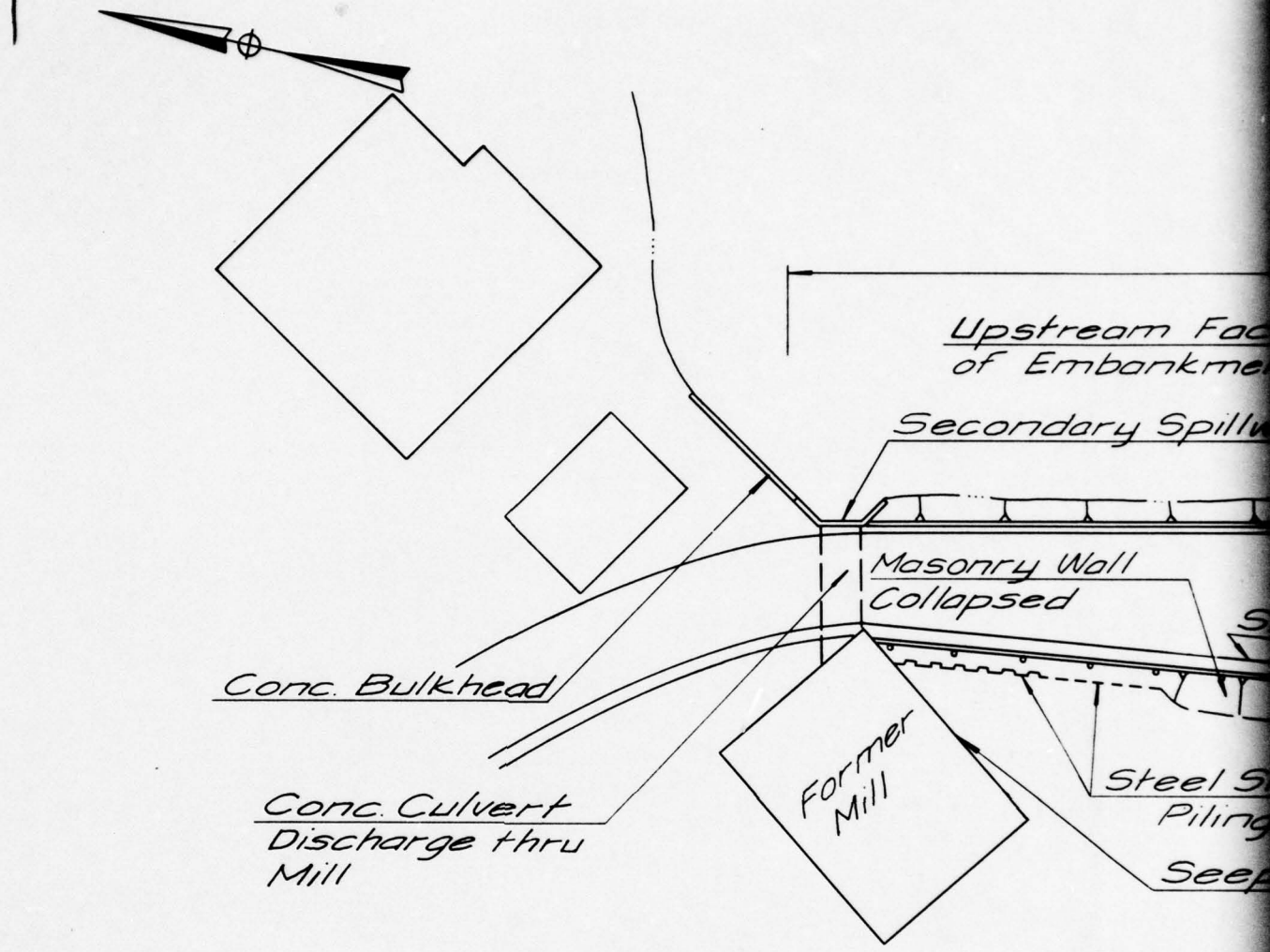
AM-24 — Unconsolidated, stratified alluvial deposits, consisting of interbedded silt, silty sand, and silty and clayey sand and gravel.

MC-6 — Stratified deposits of marine origin consisting of silt and silty clay overlying silty sand and clay. (Navesink Marl).

NOTE: Information taken from Rutgers University Soil Survey of New Jersey, Report No. 19 and Geologic Map of New Jersey prepared by Lewis and Kummel.

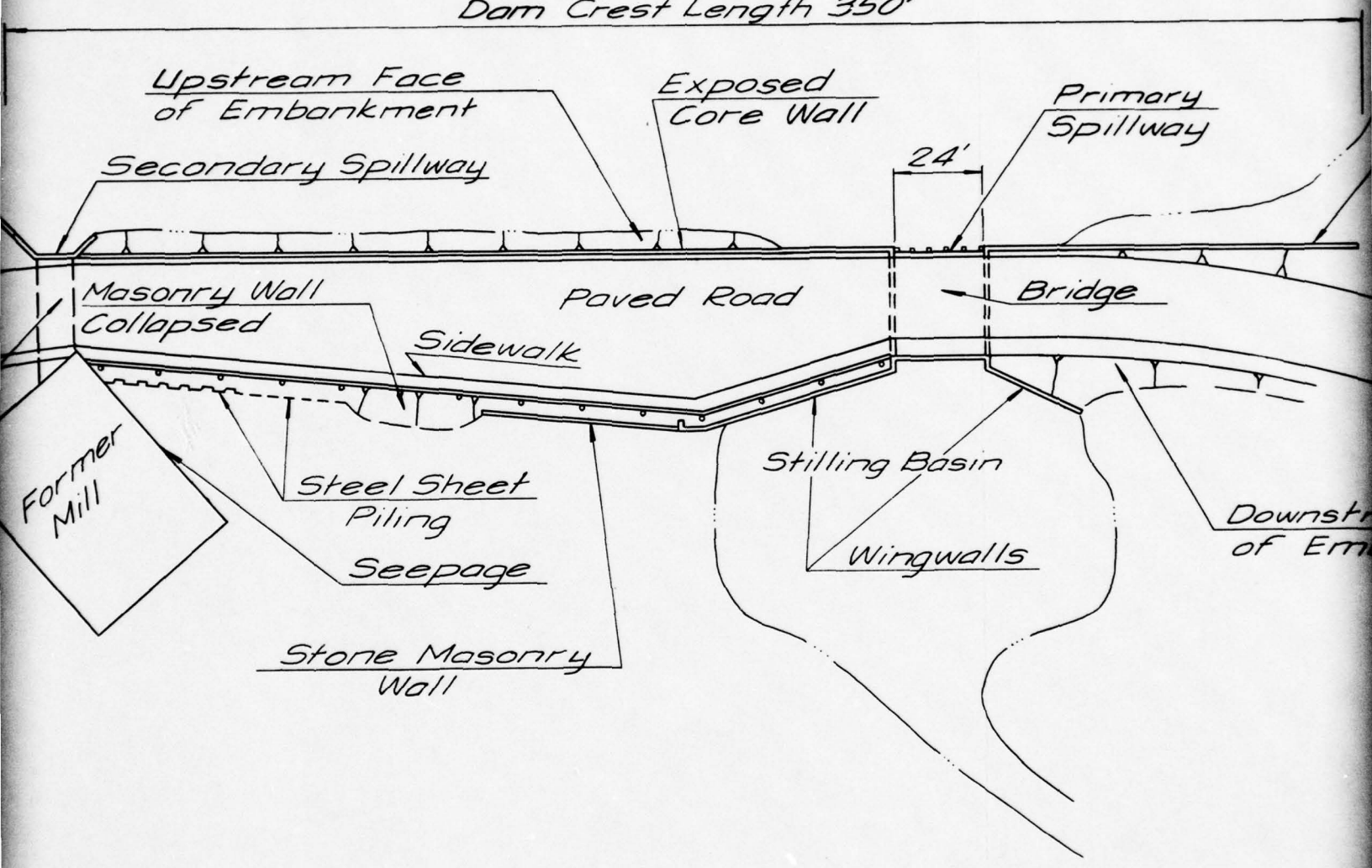
PLATE 3

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS **SOIL MAP** IMLAYSTOWN LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00218 — SCALE: NONE DATE: MARCH, 1979



NOTE:
Information taken from plans prepared by George K. Allen Jr., Monmouth Co. Engineer, dated July 1923 and Field inspection December 7

2



ans prepared
nouth Co. Engineer,
inspection December 7, 1978.

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

INSPECTION AND EVA
GENERA
IMLAYSTOWN

I.D. N.J. 00218

3

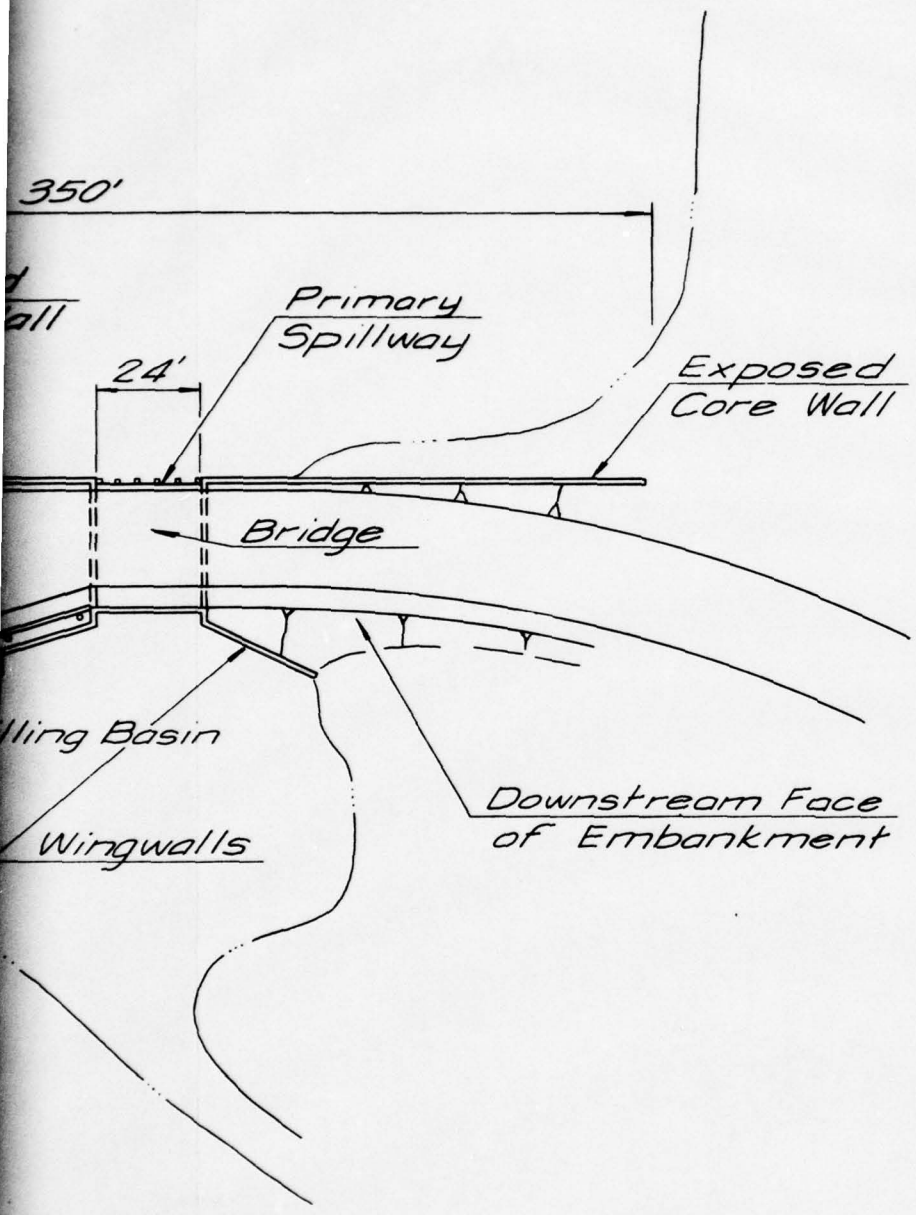


PLATE 4

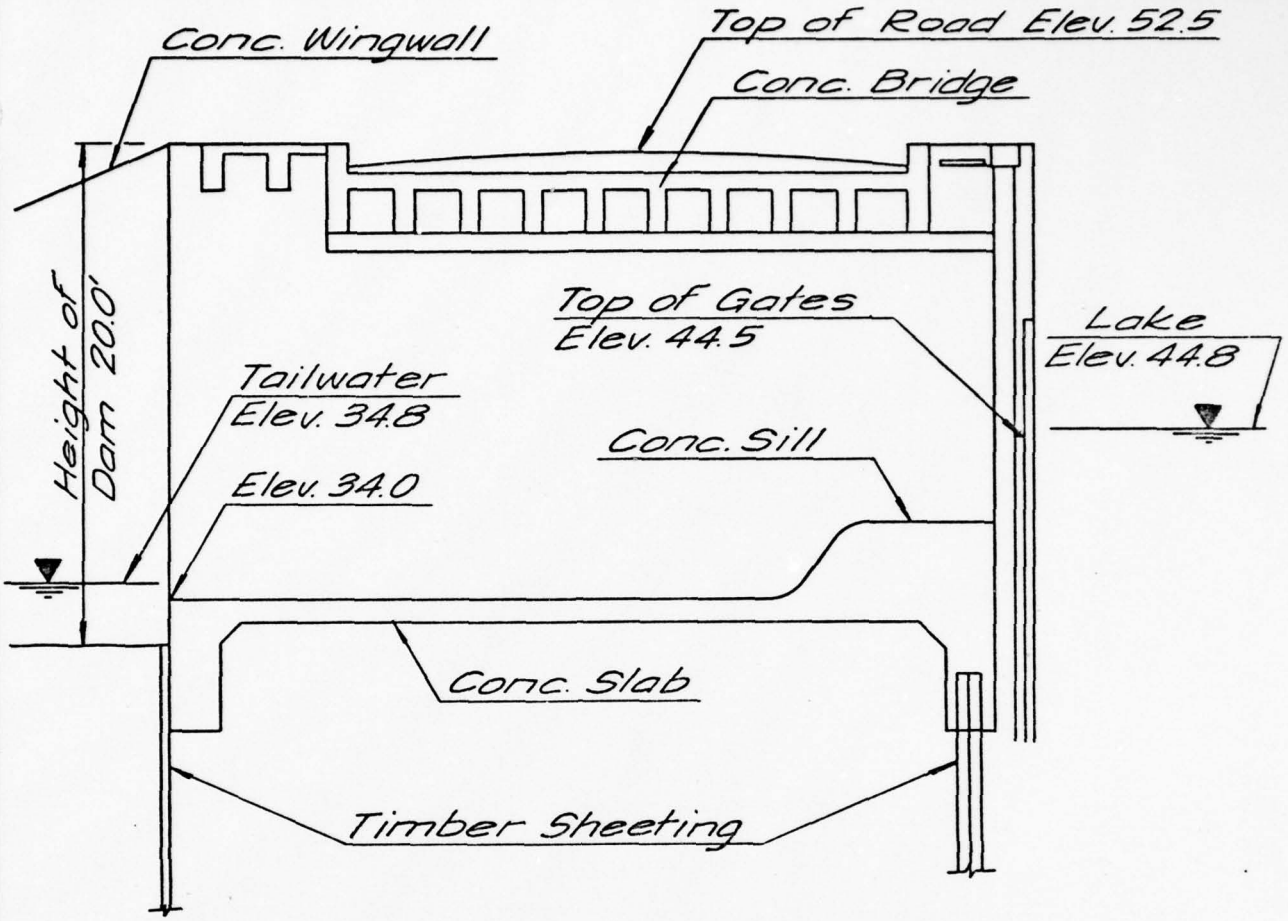
STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

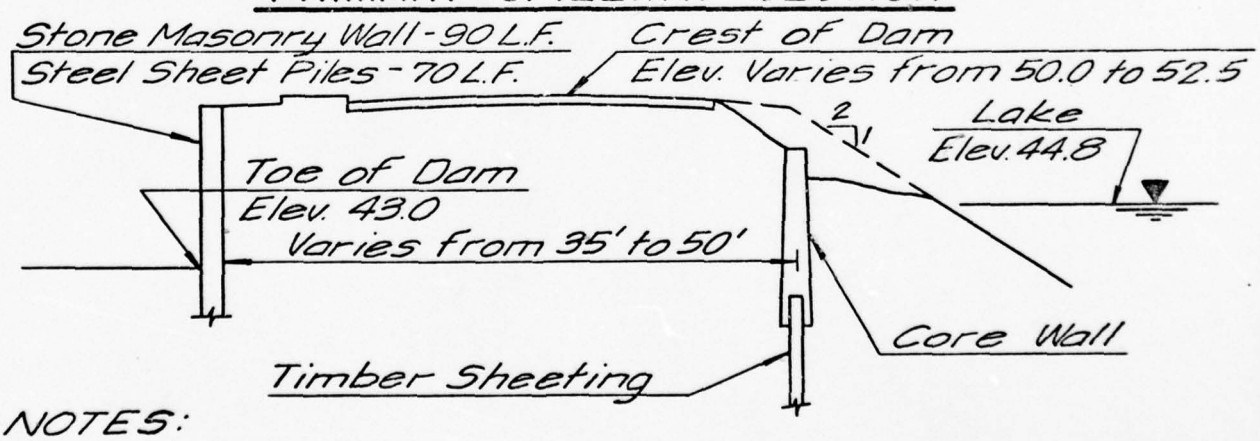
GENERAL PLAN

IMLAYSTOWN LAKE DAM

I.D. N.J. 00218	SCALE: NOT TO SCALE
	DATE: MARCH, 1979



PRIMARY SPILLWAY SECTION



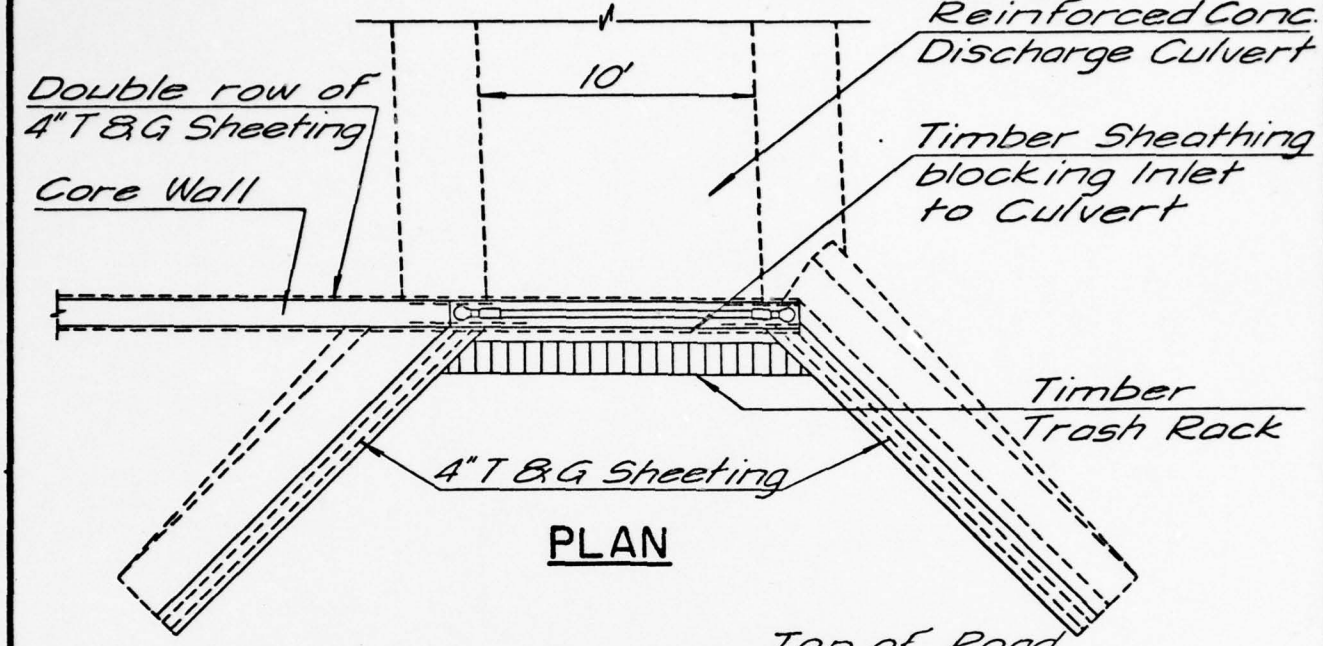
DAM SECTION

NOTES:
1. See note on Plate 4.
2. Elevations based on assumed datum.

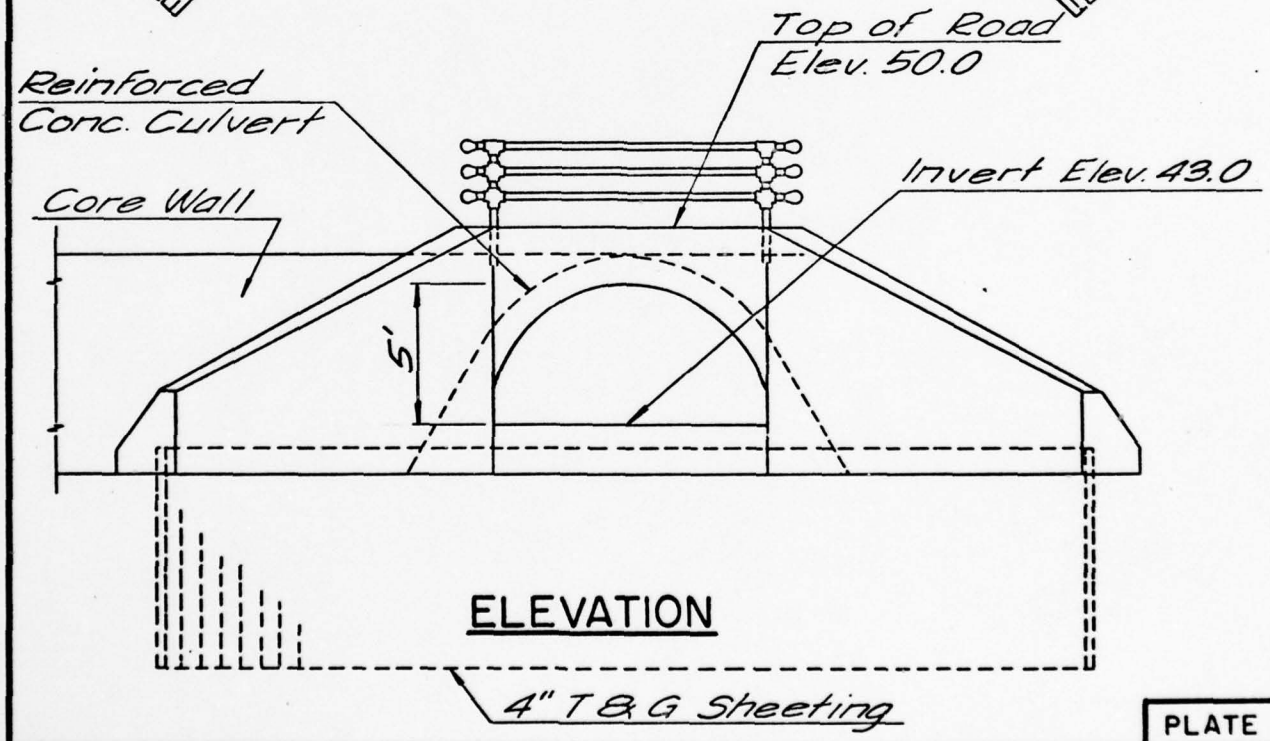
PLATE 5

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	INSPECTION AND EVALUATION OF DAMS SECTIONS IMLAYSTOWN LAKE DAM
DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY	I.D. N.J. 00218 — SCALE: NOT TO SCALE DATE: MARCH, 1979

NOTES:
1. See note on Plate 4.
2. Elevations based on assumed datum



PLAN



ELEVATION

PLATE 6

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

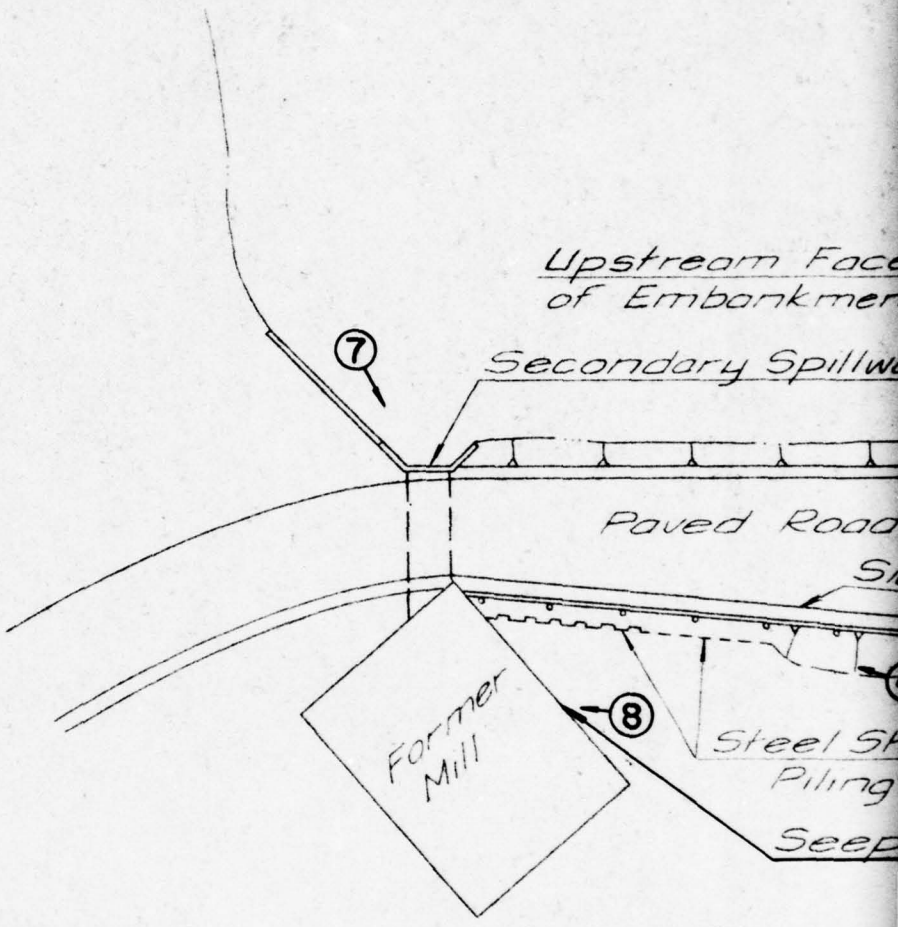
DIVISION OF WATER RESOURCES
N.J. DEPT. OF ENVIR. PROTECTION
TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS
SECONDARY SPILLWAY
IMLAYSTOWN LAKE DAM

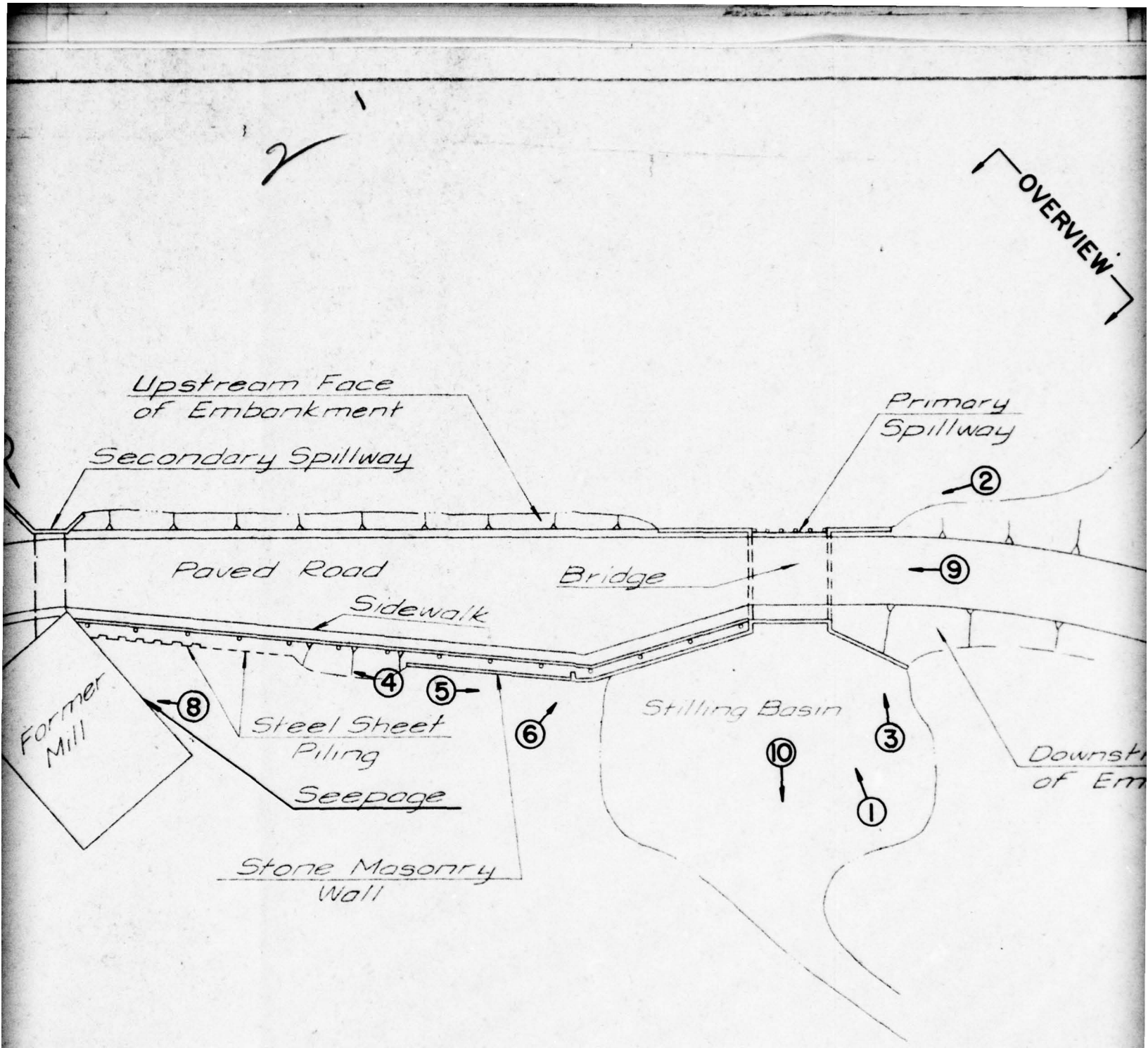
I.D. N.J. 00218

SCALE: AS SHOWN

DATE: MARCH, 1979



NOTE:
Information taken from plans prepared
by George K. Allen Jr., Monmouth Co Engineer,
dated July 1923 and field inspection December 7,



ans prepared
mouth Co Engineer,
nspection December 7, 1978.

STORCH ENGINEERS
FLORHAM PARK, NEW JERSEY

INSPECTION AND EVA

PHOTO LOCA

IMLAYSTOWN

I.D. N.J. 00218

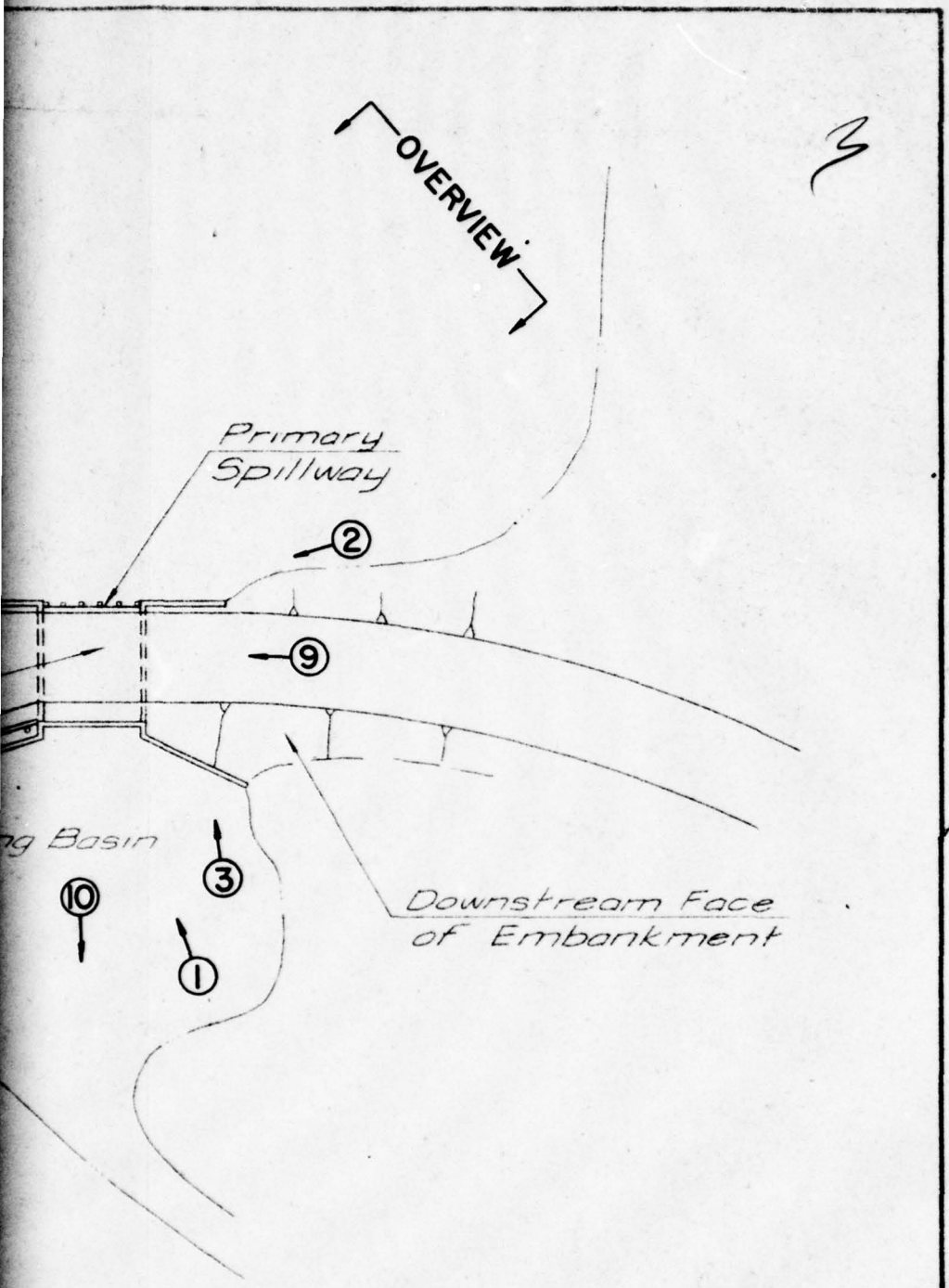


PLATE 7

STORCH ENGINEERS FLORHAM PARK, NEW JERSEY	DIVISION OF WATER RESOURCES N.J. DEPT. OF ENVIR. PROTECTION TRENTON, NEW JERSEY

INSPECTION AND EVALUATION OF DAMS

PHOTO LOCATION PLAN

IMLAYSTOWN LAKE DAM

I.D. N.J. 00218	SCALE: NOT TO SCALE
	DATE: MARCH, 1979

APPENDIX 1

Check List - Visual Inspection

Check List - Engineering Data

Check List
Visual Inspection
Phase 1

Name Dam Imlaystown Lake **County** Monmouth **State** N.J. **Coordinators** N.J.D.E.P.

Date(s) Inspection 12/7/78, 3/14/79 **Weather** Fair **Temperature** 30°F

Pool Elevation at Time of Inspection 44.8 Assumed Datum **Tailwater at Time of Inspection** 34.8 Assumed Datum

NOTE: For Approx. N.G.V.D., add 61.0 to all elevations.

Inspection Personnel:

Richard McDermott, Miron Petrovski, Alan Volle

John Gribbin, Ronald Lai

Dinesh Patel

J.Gribbin **Recorder**

Present: Fred Schmidt, Div. of Fish, Game & Shellfisheries

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE	N.A.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N.A.	
DRAINS	N.A.	
WATER PASSAGES	N.A.	
FOUNDATION	N.A.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBERSVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N.A.	
STRUCTURAL CRACKING	N.A.	
VERTICAL AND HORIZONTAL ALIGNMENT	N.A.	
MONOLITH JOINTS	N.A.	
CONSTRUCTION JOINTS	N.A.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Masonry wall in downstream face of embankment severely cracked in several locations. Longitudinal cracks in bituminous pavement of road and sidewalk on each side of bridge.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Masonry wall leaning so that its top extends farther in a downstream direction than its bottom.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Section of masonry wall collapsed and embankment severely sloughed at that location. Masonry wall cracked one foot wide with loss of material. Masonry wall undermined by scour adjacent to bridge wingwall. Upstream face of embankment severely eroded exposing core wall for entire length of dam.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Horiz. - Slightly curved Vert. - 100 feet of crest at south end level, north end of crest slopes down from bridge to secondary spillway. Dam crest at secondary spillway 2.5 feet below crest at bridge.	Low area south of dam 2.5 feet lower than dam crest at bridge.
RIPRAP FAILURES	None known	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
GENERAL	Embankment is generally grass covered. Exposed conc. core wall runs along upstream face. Stone wall and steel sheet piles run along downstream face. Extensive brush and trees on embankment slopes and beyond masonry wall and steel sheet piling.	Some trees had been cut. New shoots 2 to 3 years old growing on stumps. Steel sheet piling in satisfactory condition with some rust.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Vertical crack in stone wall approx. 2 feet from its junction with north-downstream conc. bridge abutment. Erosion of embankment at junction with south-downstream conc. bridge abutment.	
ANY NOTICEABLE SEEPAGE	Seepage observed on downstream side of steel sheet piles and adjacent to former mill.	
STAFF GAGE AND RECORDER	None	
DRAINS	None	Only the weep holes in the bridge serve as drains.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Extensive deterioration. See Primary Spillway.	
INTAKE STRUCTURE	N.A.	
OUTLET STRUCTURE	Gates. See Primary Spillway.	
OUTLET CHANNEL	Same as Primary Spillway	
EMERGENCY GATE	Gates same as Primary Spillway.	Gates reportedly not used for emergency purposes.

UNGATED SPILLWAY (SECONDARY SPILLWAY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	No weir. Timber sheathing fitted at upstream end of culvert to block flow through culvert. Low flow in culvert due to leaking around sheathing.	Timber trash rack fitted at upstream end of culvert.
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Could not be observed.	Conc. arch culvert penetrating dam a discharging through mill building..
BRIDGE AND PIERS	N.A.	

GATED SPILLWAY (PRIMARY SPILLWAY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Submerged by discharge.	
APPROACH CHANNEL	N.A.	
DISCHARGE CHANNEL	Concrete surface contains extensive spalls, cracks and deterioration.	Formed by abutments of bridge.
BRIDGE AND PIERS	Upstream and downstream wingwalls, abutments and deckwork are all extensively spalled, cracked and deteriorated.	Concrete bridge spans spillway disch channel. No piers.
GATES AND OPERATION EQUIPMENT	Gates submerged by overflow - appeared satisfactory. Timber gate supports in satisfactory condition. Gate lifting stems for three gates broken off.	5 timber slide gates.

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	N.A.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Slopes range from 2% to greater than 15%.	
SEDIMENTATION	Lake reportedly is severly silted.	Average depth 1' to 2'. Probing at spillway indicates minimum 1'-2' of silt at this location.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Shallow winding stream with wide swampy flood plain. No obstructions observed. Wide shallow stilling basin with some tree growth.	
SLOPES	Nearly level in flood plain. Slopes beyond flood plain range from 2% to greater than 15%.	
APPROXIMATE NO. OF HOMES AND POPULATION	No homes in flood plain within 4 miles of dam.	Secondary road bridge approx. 1 1/2 miles downstream of dam.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plans titled "Bridge No. U-11" (6sheets), prepared by George K. Allen, Monmouth County Engineer, dated July 1923.
REGIONAL VICINITY MAP	Available
CONSTRUCTION HISTORY	Available (limited) (NJDEP File)
TYPICAL SECTIONS OF DAM	Not Available
HYDROLOGIC/HYDRAULIC DATA	Available (NJDEP File)
OUTLETS - PLAN	Available (Allen drawing)
- DETAILS	
-CONSTRAINTS -DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	Not Available

ITEM	REMARKS
DESIGN REPORTS	Available (NJDEP File)
GEOLOGY REPORTS	Not Available
DESIGN COMPUTATIONS	Available (NJDEP File)
HYDROLOGY & HYDRAULICS	Available (NJDEP File)
DAM STABILITY	Available (NJDEP File)
SEEPAGE STUDIES	Not Available
MATERIALS INVESTIGATIONS	Available (limited) (NJDEP File)
BORING RECORDS	Available (limited) (NJDEP File)
LABORATORY	Not Available
FIELD	Not Available
POST-CONSTRUCTION SURVEYS OF DAM	Not Available.
BORROW SOURCES	Not Available

ITEM	REMARKS
MONITORING SYSTEMS	Not Available
MODIFICATIONS	Flow barrier at secondary spillway - not available
HIGH POOL RECORDS	Not Available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Not Available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	 Available (NJDEP File) Available (NJDEP File)
MAINTENANCE OPERATION RECORDS	Not Available Not Available

ITEM	REMARKS
SPILLWAY PLAN	Available - Allen drawing (limited)
SECTIONS	
DETAILS	
OPERATING EQUIPMENT PLANS & DETAILS	Not Available

APPENDIX 2

Photographs

PHOTO 1

PRIMARY SPILLWAY - DOWNSTREAM VIEW.
BRIDGE OVER SPILLWAY DISCHARGE CHANNEL.

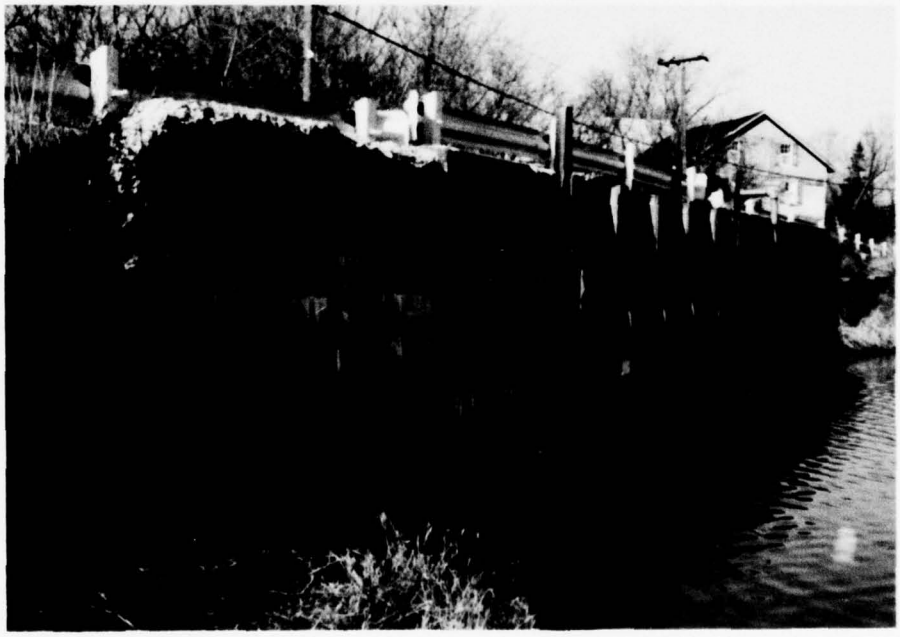


PHOTO 2

PRIMARY SPILLWAY - UPSTREAM VIEW

7 DEC. 1978

PHOTO 3

SPALLED CONCRETE IN DOWNSTREAM WINGWALL
OF BRIDGE

PHOTO 4

MOVEMENT IN DOWNSTREAM FACE OF EMBANKMENT

7 DEC. 1978

PHOTO 5

STONE WALL ALONG SECTION OF DOWNSTREAM
FACE OF EMBANKMENT

PHOTO 6

JUNCTION BETWEEN STONE WALL AND WINGWALL OF BRIDGE

7 DEC. 1978

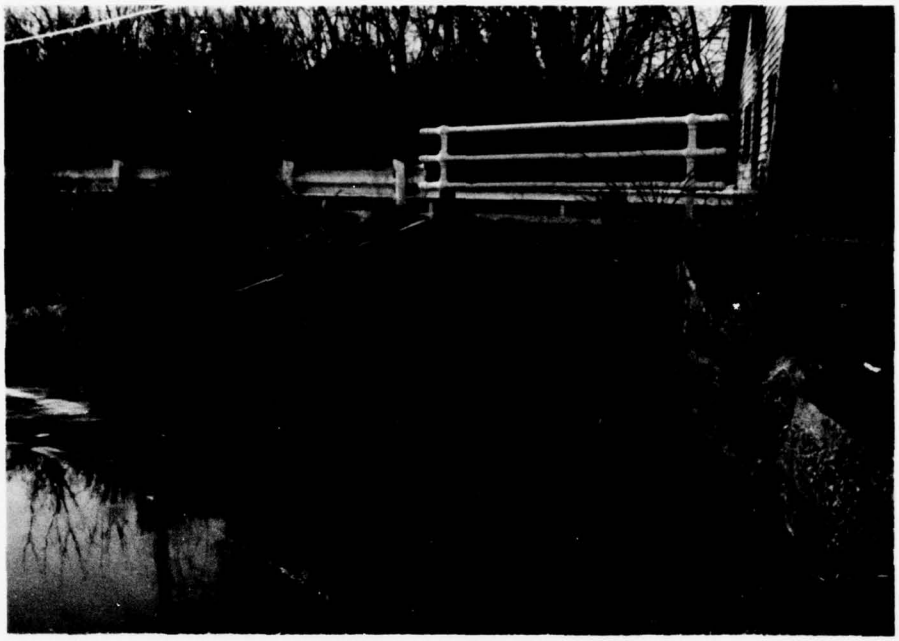


PHOTO 7

SECONDARY SPILLWAY

PHOTO 8

SEEPAGE AT TOE OF DAM UNDER FORMER MILL

7 DEC. 1978

PHOTO 9

PAVED ROAD ON CREST OF DAM

PHOTO 10

DOWNSTREAM CHANNEL

7 DEC. 1978

APPENDIX 3

Engineering Data

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 3/4 farmland, 1/4 wooded

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 44.8 (31 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N.A.

ELEVATION MAXIMUM DESIGN POOL: 52.9

ELEVATION TOP DAM: 50.0

SPILLWAY CREST: Five slide gates

- **a. Elevation** 44.5
- **b. Type** Sharp crested weir
- **c. Width** N.A.
- **d. Length** 17 feet
- **e. Location Spillover** Upstream side of dam
- **f. Number and Type of Gates** Five slide gates

OUTLET WORKS: Five slide gates

- **a. Type** slide gates
- **b. Location** same as spillway
- **c. Entrance inverts** 36.0
- **d. Exit inverts** Same as entrance
- **e. Emergency draindown facilities:** Raise slide gates

HYDROMETEOROLOGICAL GAGES: None

- **a. Type** N.A.
- **b. Location** N.A.
- **c. Records** N.A.

MAXIMUM NON-DAMAGING DISCHARGE:

(Lake stage equal to top of dam) 591 c.f.s.
(Elev. 50.0)

APPENDIX 4

Hydrologic Computations

STORCH ENGINEERS Sheet 1 of 12

Project Inlaystown Dam Made By RL Date 3-16-79

1132 Chkd By DLP Date 3-21-79

Size classification

Storage (top of dam)	188 acre-ft.
Height of dam	20 ft.
Size classification	Small

Hazard Potential Classification

Downstream structures	No homes within 4 mi. Several homes around lake at Allentown 4 mi downstream not seriously affected by dam breach. Road bridge 1.4 mi downstream.
Hazard classification	Significant
Recommended SDF	100-yr. flood

Hydrologic Analysis

The runoff hydrograph will be developed by HEC-1-DB using the SCS UHG and then routed by the modified Puls method.

Drainage area = 8.8 sq. mi

Hydrological Soil Group

From Maps No. 22, 23 of Freehold soil conservation District, soil Type in the watershed area : B

Land use

Wooded area and farmland

For infiltration use initial loss 1.0 in

and constant loss 0.1 in/hr.

Time of Concentration

Length of channel = 30,000 ft = 5.7 mi

Slope of channel = $\frac{210-108}{5.7 \times 5280} \doteq 0.34\%$

Vel. of travel from SCS TR-55 = 1'/sec

$Tc = \frac{5.7 \times 5280}{3600} = 8.36$ hr.

Alternate Method:

$Tc = \left[\frac{11.9 (L^3)}{H}\right]^{0.385} \times 2.0$ See Pg 67 "Design of Small Dams"

$= \left[\frac{11.9 (5.7^3)}{210-108}\right]^{0.385} \times 2.0$

$= 6.5$ hr.

Tc use 7 hrs

$T_{lag} = 0.6 \times 7 = \underline{4.2}$ hrs

STORCH ENGINEERS

Sheet 3 of 12

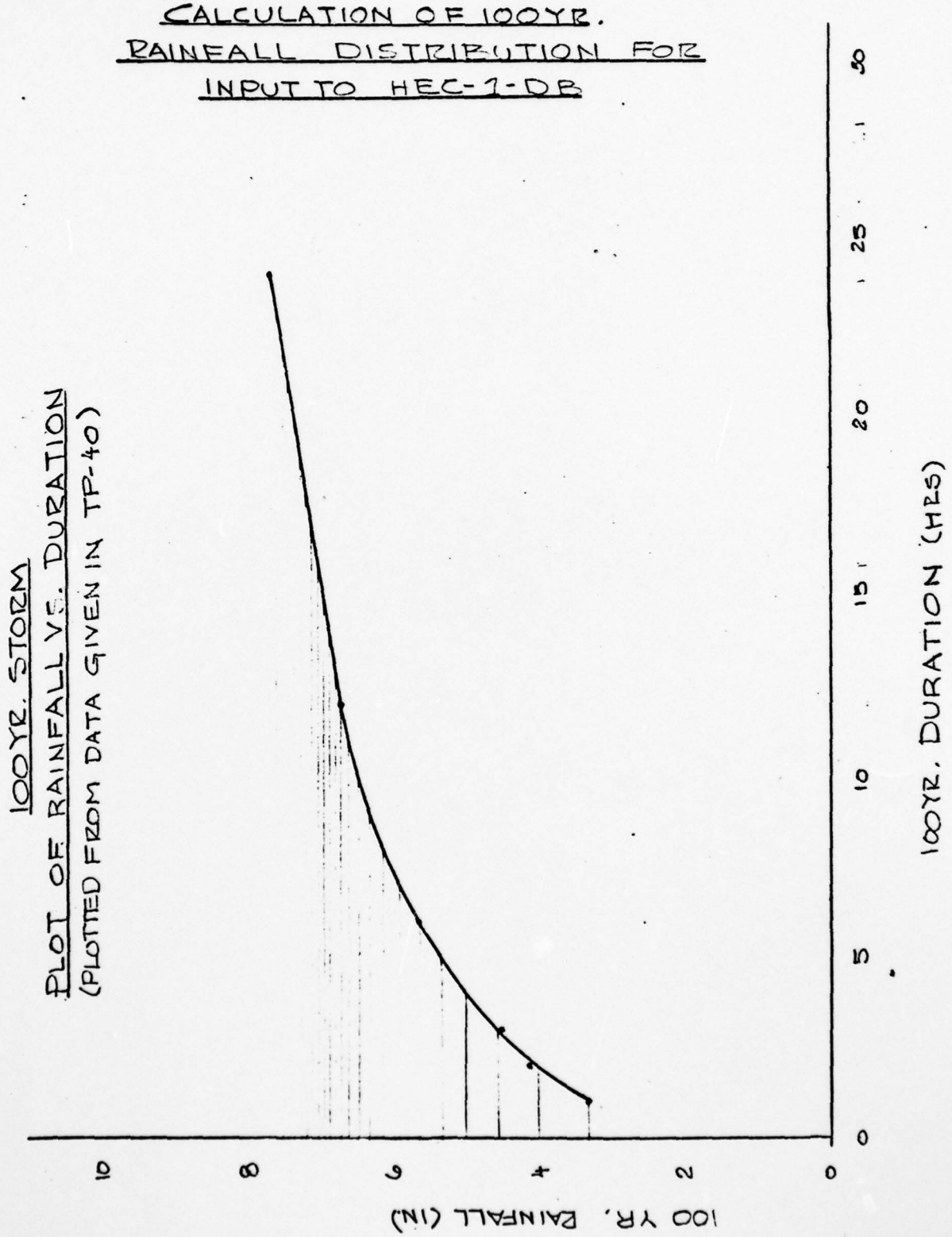
Project S.E. # 1132

Made By EAW Date MAR. 20, 1979

LAYSTOWN LAKE DAM

Chkd By _____ Date _____

CALCULATION OF 100YR. RAINFALL DISTRIBUTION FOR INPUT TO HEC-1-DB



RAINFALL DISTRIBUTION-

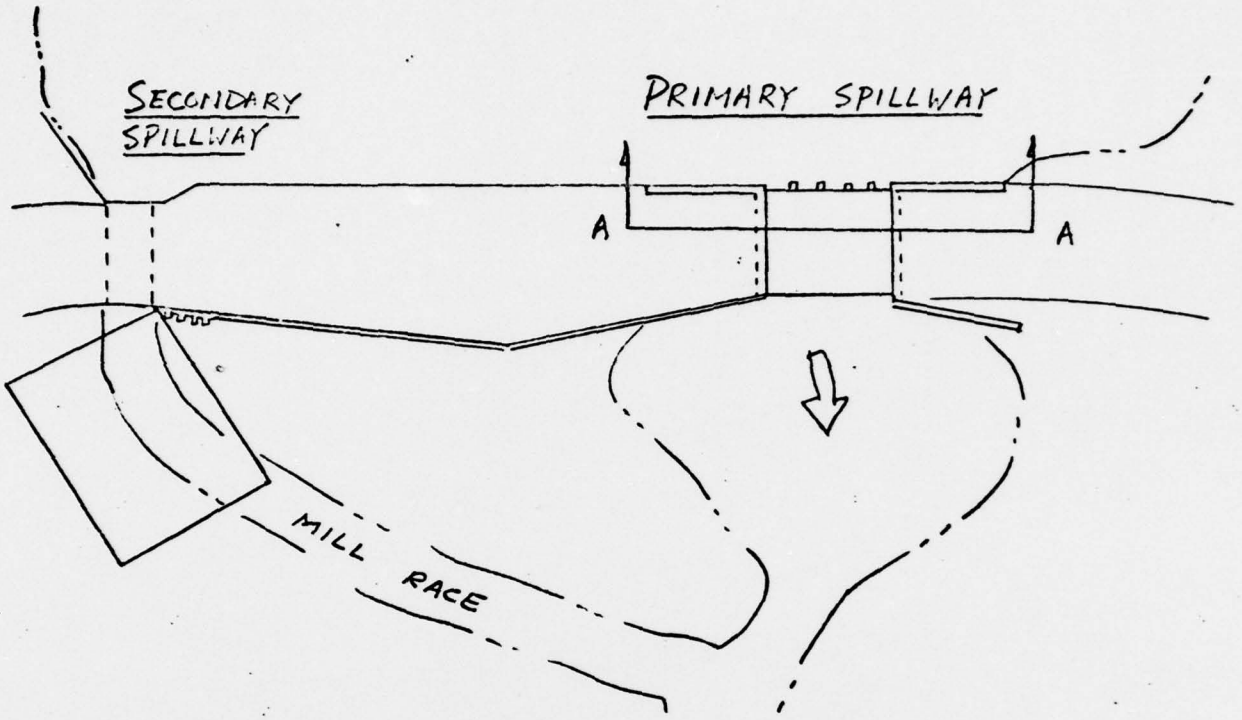
100YR DURATION (HRS)	RAINFALL (IN)	INCREMENTAL RAINFALL (IN)
1	3.30	0.70
2	4.00	0.55
3	4.55	0.45
4	5.00	0.30
5	5.30	0.30
6	5.60	0.30
7	5.90	0.20
8	6.10	0.20
9	6.30	0.15
10	6.45	0.15
11	6.60	0.12
12	6.72	0.10
13	6.82	0.10
14	6.92	0.08
15	7.00	0.08
16	7.08	0.08
17	7.16	0.08
18	7.24	0.08
19	7.32	0.08
20	7.40	0.08
21	7.48	0.08
22	7.56	0.08
23	7.64	0.08
24	7.70	0.06

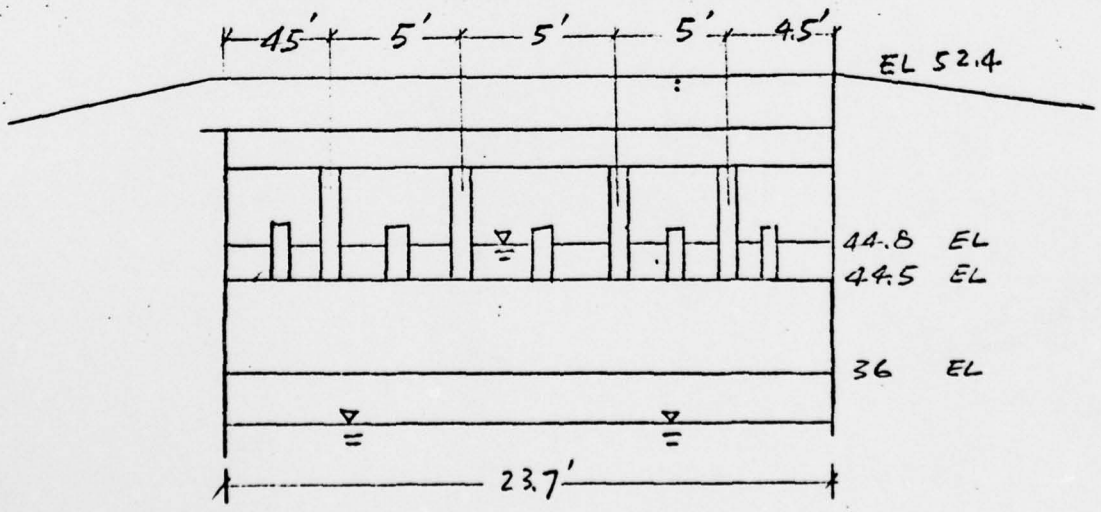
STORM TIME (HR)	RAINFALL (IN)
1	0.06
2	0.08
3	0.08
4	0.08
5	0.08
6	0.10
7	0.12
8	0.15
9	0.20
10	0.30
11	0.45
12	0.70
13	3.30
14	0.55
15	0.30
16	0.30
17	0.20
18	0.15
19	0.10
20	0.08
21	0.08
22	0.08
23	0.08
24	0.08
	7.70 TOTAL

Lake Storage Volume

Information from USGS & Aerial photos

EL. (ft)	39	45	47	49	59
Surface area (AC)	0	20	24	39	110


SECONDARY SPILLWAY
PRIMARY SPILLWAY
A
A
MILL RACE


45'
5'
5'
5'
4.5'
EL 52.4
44.8 EL
44.5 EL
36 EL
23.7'

SECTION A A

Elevation – Discharge Tabulation

Ref. Pg 373 "Design of Small Dams"

Total length of spillway = 24 ft.

Discharge will be calculated by the following formulas:

$$Q = CLH^{3/2}$$

$$L = L' - 2(NKp + Ka)H$$

where L = effective length of crest
L' = net length of crest
N = number of piers
Kp = pier contraction coef.
Ka = abutment contraction coef.
H = total head

$N_1 = 9$ for H from 0' to 2'

$N_2 = 4$ for H over 2'

Kp for square nose pier with corners rounded = 0.02

Ka abutments = 0.2

To be conservative use N = 9 throughout

$$L = (24 - 6.8) - 2(9 \times 0.02 + 0.2)H$$

$$= \underline{17.2 - 0.76H}$$

STAGE DISCHARGE TABULATION (Spillway)
(H = above 445)

WL (ft)	H (ft)	C	L (ft)	$H^{3/2}$	$Q = CLH^{3/2}$ (cfs)
44.5	0	0	-	0	0
45.0	0.5	3.0	16.82	0.35	18
45.5	1.0	3.3	16.44	1.00	54
46.0	1.5	3.3	16.06	1.84	98
46.5	2.0	3.3	15.68	2.83	146
47.0	2.5	3.3	15.30	3.95	199
47.5	3.0	3.3	14.92	5.20	256
48.0	3.5	3.3	14.54	6.55	314
48.8	4.3	3.3	13.93	8.92	410
		Orifice flow starts here			
49.5		h = 2.85		Qor = 650	
50.0		h = 3.35		Qor = 705	

(To be cont. next page)

STAGE DISCHARGE TABULATION (CONT.)

NOTE: AS WL. rises above 48.8, the spillway will act as an orifice. Q values in the following table for overtopping do not include flow over 100' of bridge as the HEC-1-DB program will calculate the same.

W.L. (ft)	H (ft) (WL-50)	h (ft) (WL-46.65)	L (ft)	C=2.63 Qov (cfs)	Qor (cfs)	ΣQ (cfs)
51	1.0	4.35	(a)	300	803	1103
52	2.0	5.35	(a,b)	1295	891	2186
53	3.0	6.35	(abc)	3285	971	4256
54	4.0	7.35	(abc)	6031	1045	7076
55	5.0	8.35	(abc)	9334	1114	10448

H = head for overtopping
h = head for orifice
(a,b,c.) = levels, see figure next page

Qov = Q overtopping

Qor = Q orifice

$Q = CA\sqrt{2gh}$

A = 172 x 4.3 + 6.25 ≒ 80
C = 0.6
h = WL - 46.65

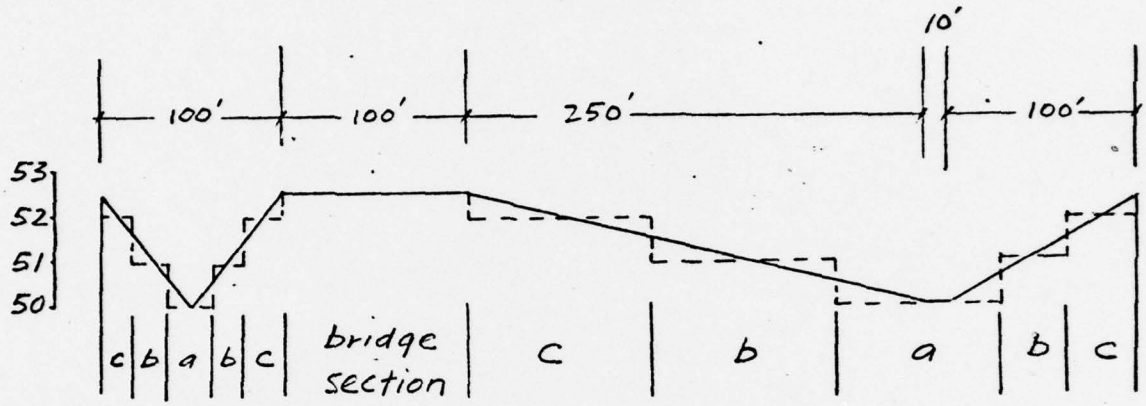
STORCH ENGINEERS

Sheet 10 of 12

Project Tunkhannock Dam — Made By RL Date 3-22-79

1132 — Chkd By DMF Date 3-27-79

Overtopping Assumptions



Field inspection indicated two low-points along the dam as shown above. For the purpose of hydraulic calculation, it will be approximated to be a series of straight weirs.

Length of Level a = 114 ft
" " " b = 170 ft
" " " c = 176 ft

Q-Bridge section to be computed by HEC-1-DB

STORCH ENGINEERS

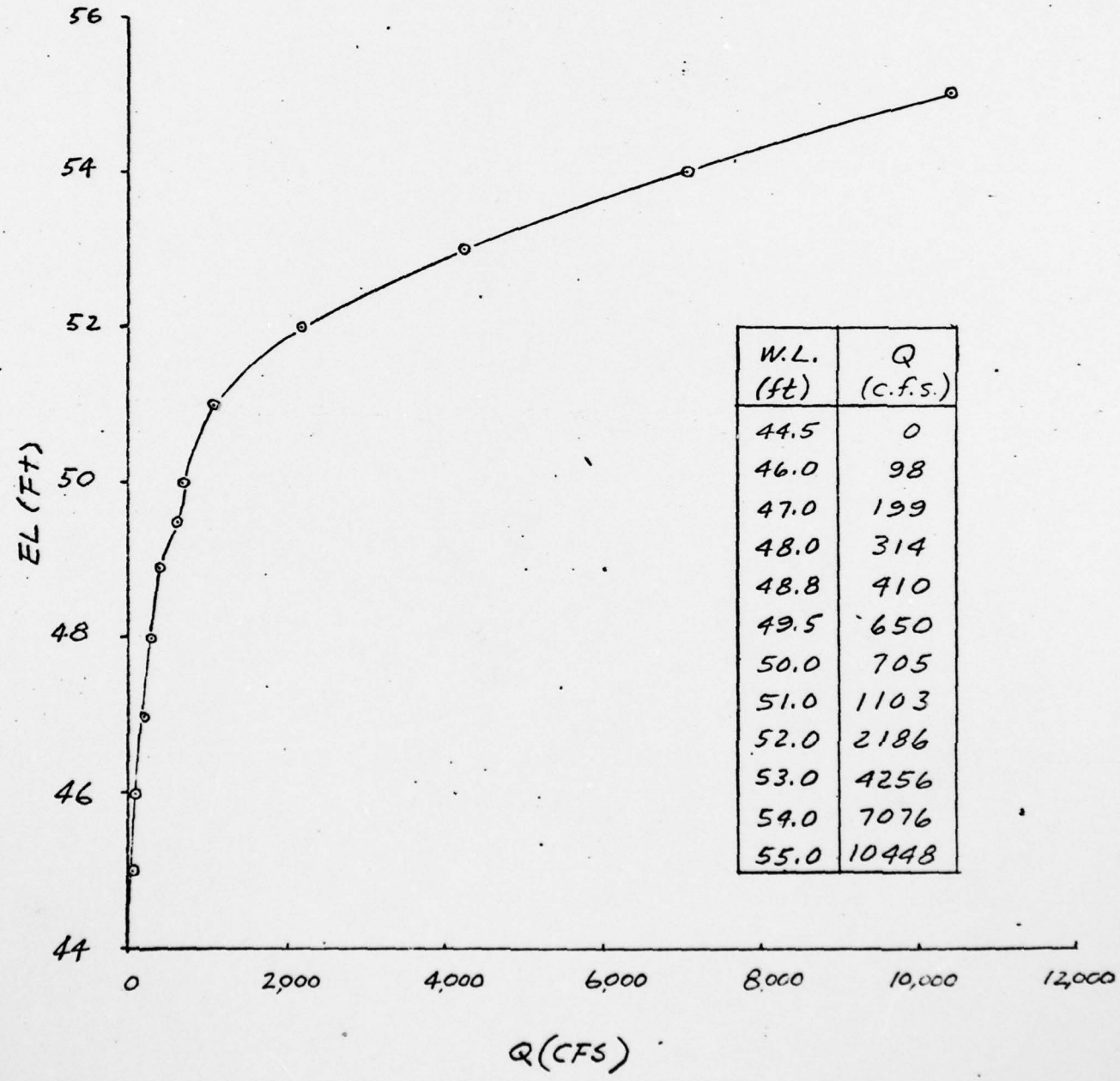
Sheet 11 of 12

Project Inlaystown Dam 1132

Made By RL Date 3-16-79

Chkd By [illegible] Date [illegible]

STAGE DISCHARGE CURVE



W.L. (ft)	Q (c.f.s.)
44.5	0
46.0	98
47.0	199
48.0	314
48.8	410
49.5	650
50.0	705
51.0	1103
52.0	2186
53.0	4256
54.0	7076
55.0	10448

Capacity of Outlet works

Assume drawdown by opening 2 gate only. Dimension of opening 7'(net) x 9'(below WL) Further divided into 4 parts by 2-7½" wide and 1-11" wide timber.
Assume sediment is cleaned out.

use $L = L' - 2(N Kp + Ka)h$

$N = 3$

$L' = 7'$

$Kp = 0.02$

$Ka = 0.2$

$L = 7 - 2(0.06 + 0.2)h$

$= 7 - 0.52h$

For W.L. = 44.8

$h = 44.8 - 36 = 8.8'$

$L = 7 - 0.52(8.8)$

$= 2.42$

$Q = 3.3\,(2.42)\,(8.8)^{3/2}$

$= \underline{\underline{208 \text{ cfs.}}}$

HEC-1-DB COMPUTATIONS

AD-A069 613 NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. IMLAYSTOWN LAKE DAM (NJ00218), DEL--ETC(U)
MAY 79 R J MCDERMOTT DACW61-78-C-0124

UNCLASSIFIED NL

2 OF 2
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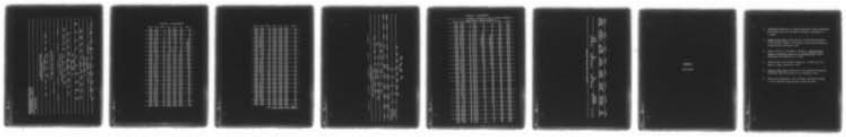
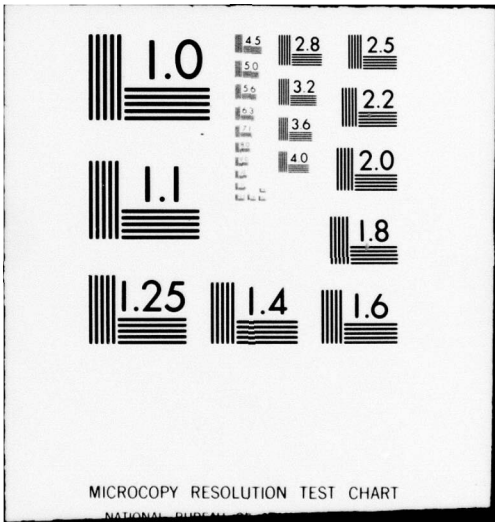


END
DATE
FILMED
7-79
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  11 JAN 79
**********

RUN  DATE# 79/03/21.
     TIME# 15.47.50.
```

NATIONAL DAM SAFETY PROGRAM
IMLAYSTOWN DAM JACKSON NEW JERSEY
100 YEAR STORM ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	1	0	0	0	0	0	0	5	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

SUBAREA RUNOFF FOR IMLAYSTOWN LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
IMY	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	8.80	0.00	8.80	1.00	0.000	0	1	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.00	0.00	0.00

PRECIP PATTERN

.08	.08	.08	.08	.08	.10	.12	.15	.20	.30
.45	.70	3.30	.55	.30	.30	.20	.15	.10	.08
.08	.08	.08	.08						

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 4.20

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 23 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 4.20 VOL= 1.00

101.	317.	653.	869.	899.	793.	625.	415.	292.	211.
149.	105.	74.	52.	37.	26.	19.	13.	9.	7.
5.	3.	1.							

INFLOW HYDROGRAPH

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	1.00	1	.08	0.00	.08	8.
1.01	2.00	2	.08	0.00	.08	8.
1.01	3.00	3	.08	0.00	.08	7.
1.01	4.00	4	.08	0.00	.08	7.
1.01	5.00	5	.08	0.00	.08	6.
1.01	6.00	6	.10	0.00	.10	6.
1.01	7.00	7	.12	0.00	.12	5.
1.01	8.00	8	.15	0.00	.15	5.
1.01	9.00	9	.20	0.00	.20	5.
1.01	10.00	10	.30	.18	.12	23.
1.01	11.00	11	.45	.35	.10	97.
1.01	12.00	12	.70	.60	.10	293.
1.01	13.00	13	3.30	3.20	.10	902.
1.01	14.00	14	.55	.45	.10	1922.
1.01	15.00	15	.30	.20	.10	3234.
1.01	16.00	16	.30	.20	.10	4092.
1.01	17.00	17	.20	.10	.10	4244.
1.01	18.00	18	.15	.05	.10	3859.
1.01	19.00	19	.10	0.00	.10	3183.
1.01	20.00	20	.08	0.00	.08	2345.
1.01	21.00	21	.08	0.00	.08	1738.
1.01	22.00	22	.08	0.00	.08	1281.
1.01	23.00	23	.08	0.00	.08	916.
1.02	0.00	24	.08	0.00	.08	648.
1.02	1.00	25	0.00	0.00	0.00	457.
1.02	2.00	26	0.00	0.00	0.00	322.
1.02	3.00	27	0.00	0.00	0.00	228.
1.02	4.00	28	0.00	0.00	0.00	201.
1.02	5.00	29	0.00	0.00	0.00	188.
1.02	6.00	30	0.00	0.00	0.00	175.
1.02	7.00	31	0.00	0.00	0.00	164.
1.02	8.00	32	0.00	0.00	0.00	153.
1.02	9.00	33	0.00	0.00	0.00	142.
1.02	10.00	34	0.00	0.00	0.00	133.
1.02	11.00	35	0.00	0.00	0.00	124.
1.02	12.00	36	0.00	0.00	0.00	116.
1.02	13.00	37	0.00	0.00	0.00	108.
1.02	14.00	38	0.00	0.00	0.00	101.
1.02	15.00	39	0.00	0.00	0.00	94.
1.02	16.00	40	0.00	0.00	0.00	88.
1.02	17.00	41	0.00	0.00	0.00	82.
1.02	18.00	42	0.00	0.00	0.00	76.
1.02	19.00	43	0.00	0.00	0.00	71.
1.02	20.00	44	0.00	0.00	0.00	66.
1.02	21.00	45	0.00	0.00	0.00	62.
1.02	22.00	46	0.00	0.00	0.00	58.
1.02	23.00	47	0.00	0.00	0.00	54.
1.03	0.00	48	0.00	0.00	0.00	50.
1.03	1.00	49	0.00	0.00	0.00	47.
1.03	2.00	50	0.00	0.00	0.00	44.
1.03	3.00	51	0.00	0.00	0.00	41.
1.03	4.00	52	0.00	0.00	0.00	38.
1.03	5.00	53	0.00	0.00	0.00	36.
1.03	6.00	54	0.00	0.00	0.00	33.
1.03	7.00	55	0.00	0.00	0.00	31.
1.03	8.00	56	0.00	0.00	0.00	29.
1.03	9.00	57	0.00	0.00	0.00	27.
1.03	10.00	58	0.00	0.00	0.00	25.
1.03	11.00	59	0.00	0.00	0.00	23.
1.03	12.00	60	0.00	0.00	0.00	22.
1.03	13.00	61	0.00	0.00	0.00	20.
1.03	14.00	62	0.00	0.00	0.00	19.
1.03	15.00	63	0.00	0.00	0.00	18.
1.03	16.00	64	0.00	0.00	0.00	17.
1.03	17.00	65	0.00	0.00	0.00	16.
1.03	18.00	66	0.00	0.00	0.00	14.
1.03	19.00	67	0.00	0.00	0.00	13.
1.03	20.00	68	0.00	0.00	0.00	13.
1.03	21.00	69	0.00	0.00	0.00	12.
1.03	22.00	70	0.00	0.00	0.00	11.
1.03	23.00	71	0.00	0.00	0.00	10.
1.04	0.00	72	0.00	0.00	0.00	10.
1.04	1.00	73	0.00	0.00	0.00	9.
1.04	2.00	74	0.00	0.00	0.00	8.
1.04	3.00	75	0.00	0.00	0.00	8.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.04	4.00	76	0.00	0.00	0.00	7.
1.04	5.00	77	0.00	0.00	0.00	7.
1.04	6.00	78	0.00	0.00	0.00	6.
1.04	7.00	79	0.00	0.00	0.00	6.
1.04	8.00	80	0.00	0.00	0.00	5.
1.04	9.00	81	0.00	0.00	0.00	5.
1.04	10.00	82	0.00	0.00	0.00	5.
1.04	11.00	83	0.00	0.00	0.00	4.
1.04	12.00	84	0.00	0.00	0.00	4.
1.04	13.00	85	0.00	0.00	0.00	4.
1.04	14.00	86	0.00	0.00	0.00	4.
1.04	15.00	87	0.00	0.00	0.00	3.
1.04	16.00	88	0.00	0.00	0.00	3.
1.04	17.00	89	0.00	0.00	0.00	3.
1.04	18.00	90	0.00	0.00	0.00	3.
1.04	19.00	91	0.00	0.00	0.00	3.
1.04	20.00	92	0.00	0.00	0.00	2.
1.04	21.00	93	0.00	0.00	0.00	2.
1.04	22.00	94	0.00	0.00	0.00	2.
1.04	23.00	95	0.00	0.00	0.00	2.
1.05	0.00	96	0.00	0.00	0.00	2.
1.05	1.00	97	0.00	0.00	0.00	2.
1.05	2.00	98	0.00	0.00	0.00	2.
1.05	3.00	99	0.00	0.00	0.00	1.
1.05	4.00	100	0.00	0.00	0.00	1.
1.05	5.00	101	0.00	0.00	0.00	1.
1.05	6.00	102	0.00	0.00	0.00	1.
1.05	7.00	103	0.00	0.00	0.00	1.
1.05	8.00	104	0.00	0.00	0.00	1.
1.05	9.00	105	0.00	0.00	0.00	1.
1.05	10.00	106	0.00	0.00	0.00	1.
1.05	11.00	107	0.00	0.00	0.00	1.
1.05	12.00	108	0.00	0.00	0.00	1.
1.05	13.00	109	0.00	0.00	0.00	1.
1.05	14.00	110	0.00	0.00	0.00	1.
1.05	15.00	111	0.00	0.00	0.00	1.
1.05	16.00	112	0.00	0.00	0.00	1.
1.05	17.00	113	0.00	0.00	0.00	1.
1.05	18.00	114	0.00	0.00	0.00	1.
1.05	19.00	115	0.00	0.00	0.00	0.
1.05	20.00	116	0.00	0.00	0.00	0.
1.05	21.00	117	0.00	0.00	0.00	0.
1.05	22.00	118	0.00	0.00	0.00	0.
1.05	23.00	119	0.00	0.00	0.00	0.
1.06	0.00	120	0.00	0.00	0.00	0.
1.06	1.00	121	0.00	0.00	0.00	0.
1.06	2.00	122	0.00	0.00	0.00	0.
1.06	3.00	123	0.00	0.00	0.00	0.
1.06	4.00	124	0.00	0.00	0.00	0.
1.06	5.00	125	0.00	0.00	0.00	0.
1.06	6.00	126	0.00	0.00	0.00	0.
1.06	7.00	127	0.00	0.00	0.00	0.
1.06	8.00	128	0.00	0.00	0.00	0.
1.06	9.00	129	0.00	0.00	0.00	0.
1.06	10.00	130	0.00	0.00	0.00	0.
1.06	11.00	131	0.00	0.00	0.00	0.
1.06	12.00	132	0.00	0.00	0.00	0.
1.06	13.00	133	0.00	0.00	0.00	0.
1.06	14.00	134	0.00	0.00	0.00	0.
1.06	15.00	135	0.00	0.00	0.00	0.
1.06	16.00	136	0.00	0.00	0.00	0.
1.06	17.00	137	0.00	0.00	0.00	0.
1.06	18.00	138	0.00	0.00	0.00	0.
1.06	19.00	139	0.00	0.00	0.00	0.
1.06	20.00	140	0.00	0.00	0.00	0.
1.06	21.00	141	0.00	0.00	0.00	0.
1.06	22.00	142	0.00	0.00	0.00	0.
1.06	23.00	143	0.00	0.00	0.00	0.
1.07	0.00	144	0.00	0.00	0.00	0.
1.07	1.00	145	0.00	0.00	0.00	0.
1.07	2.00	146	0.00	0.00	0.00	0.
1.07	3.00	147	0.00	0.00	0.00	0.
1.07	4.00	148	0.00	0.00	0.00	0.
1.07	5.00	149	0.00	0.00	0.00	0.
1.07	6.00	150	0.00	0.00	0.00	0.
		SUM	7.72	5.33	2.39	32843.
			(196.)	(135.)	(61.)	(930.01)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE DISCHARGE THRU IMLAYSTOWN DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-45.	-1

STAGE	44.50	45.00	45.50	46.00	46.50	47.00	47.50	48.00	48.80	50.00
	51.00	52.00	53.00	54.00	55.00					
FLOW	0.00	18.00	54.00	98.00	146.00	199.00	256.00	314.00	410.00	591.00
	1103.00	2186.00	4256.00	7076.00	10448.00					
SURFACE AREA=	0.	20.	24.	39.	110.					
CAPACITY=	0.	40.	84.	146.	861.					
ELEVATION=	39.	45.	47.	49.	59.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
44.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
52.4	2.6	1.5	100.

OUTFLOW HYDROGRAPH

STATION DAM, PLAN 1, RATIO 1 (100-yr. storm)

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	1.00	1	1.00	8.	1.	31.	44.5
1.01	2.00	2	2.00	8.	2.	32.	44.6
1.01	3.00	3	3.00	7.	3.	32.	44.6
1.01	4.00	4	4.00	7.	4.	33.	44.6
1.01	5.00	5	5.00	6.	4.	33.	44.6
1.01	6.00	6	6.00	6.	4.	33.	44.6
1.01	7.00	7	7.00	5.	5.	33.	44.6
1.01	8.00	8	8.00	5.	5.	33.	44.6
1.01	9.00	9	9.00	5.	5.	33.	44.6
1.01	10.00	10	10.00	23.	6.	34.	44.7
1.01	11.00	11	11.00	97.	14.	38.	44.9
1.01	12.00	12	12.00	293.	57.	51.	45.5
1.01	13.00	13	13.00	902.	222.	89.	47.2
1.01	14.00	14	14.00	1922.	542.	174.	49.7
1.01	15.00	15	15.00	3234.	2030.	281.	51.9
1.01	16.00	16	16.00	4092.	3937.	337.	52.8
1.01	17.00	17	17.00	4244.	4218.	344.	52.9
1.01	18.00	18	18.00	3859.	4015.	339.	52.8
1.01	19.00	19	19.00	3183.	3415.	323.	52.6
1.01	20.00	20	20.00	2345.	2637.	301.	52.2
1.01	21.00	21	21.00	1738.	1991.	279.	51.8
1.01	22.00	22	22.00	1281.	1555.	257.	51.4
1.01	23.00	23	23.00	916.	1131.	237.	51.0
1.02	0.00	24	24.00	648.	911.	217.	50.6
1.02	1.00	25	25.00	457.	688.	197.	50.2
1.02	2.00	26	26.00	322.	555.	177.	49.8
1.02	3.00	27	27.00	228.	482.	157.	49.3
1.02	4.00	28	28.00	201.	409.	138.	48.8
1.02	5.00	29	29.00	188.	356.	123.	48.4
1.02	6.00	30	30.00	175.	310.	110.	48.0
1.02	7.00	31	31.00	164.	271.	100.	47.6
1.02	8.00	32	32.00	153.	237.	92.	47.3
1.02	9.00	33	33.00	142.	209.	86.	47.1
1.02	10.00	34	34.00	133.	187.	81.	46.9
1.02	11.00	35	35.00	124.	168.	77.	46.7
1.02	12.00	36	36.00	116.	153.	74.	46.6
1.02	13.00	37	37.00	108.	140.	71.	46.4
1.02	14.00	38	38.00	101.	130.	68.	46.3
1.02	15.00	39	39.00	94.	120.	66.	46.2
1.02	16.00	40	40.00	88.	111.	64.	46.1
1.02	17.00	41	41.00	82.	103.	62.	46.1
1.02	18.00	42	42.00	76.	96.	60.	46.0
1.02	19.00	43	43.00	71.	90.	59.	45.9
1.02	20.00	44	44.00	66.	84.	57.	45.8
1.02	21.00	45	45.00	62.	78.	56.	45.8
1.02	22.00	46	46.00	58.	73.	55.	45.7
1.02	23.00	47	47.00	54.	68.	54.	45.7
1.03	0.00	48	48.00	50.	63.	52.	45.6
1.03	1.00	49	49.00	47.	59.	51.	45.6
1.03	2.00	50	50.00	44.	55.	50.	45.5
1.03	3.00	51	51.00	41.	52.	50.	45.5
1.03	4.00	52	52.00	38.	49.	49.	45.4
1.03	5.00	53	53.00	36.	46.	48.	45.4
1.03	6.00	54	54.00	33.	43.	47.	45.3
1.03	7.00	55	55.00	31.	40.	46.	45.3
1.03	8.00	56	56.00	29.	38.	46.	45.3
1.03	9.00	57	57.00	27.	35.	45.	45.2
1.03	10.00	58	58.00	25.	33.	44.	45.2
1.03	11.00	59	59.00	23.	31.	44.	45.2
1.03	12.00	60	60.00	22.	29.	43.	45.1
1.03	13.00	61	61.00	20.	27.	42.	45.1
1.03	14.00	62	62.00	19.	25.	42.	45.1
1.03	15.00	63	63.00	18.	23.	41.	45.1
1.03	16.00	64	64.00	17.	22.	41.	45.1
1.03	17.00	65	65.00	16.	20.	41.	45.0
1.03	18.00	66	66.00	14.	19.	40.	45.0
1.03	19.00	67	67.00	13.	18.	40.	45.0
1.03	20.00	68	68.00	13.	17.	40.	45.0
1.03	21.00	69	69.00	12.	16.	39.	45.0
1.03	22.00	70	70.00	11.	16.	39.	44.9
1.03	23.00	71	71.00	10.	15.	38.	44.9
1.04	0.00	72	72.00	10.	14.	38.	44.9
1.04	1.00	73	73.00	9.	14.	38.	44.9
1.04	2.00	74	74.00	8.	13.	37.	44.9
1.04	3.00	75	75.00	8.	12.	37.	44.8
1.04	4.00	76	76.00	7.	12.	37.	44.8
1.04	5.00	77	77.00	7.	11.	36.	44.8
1.04	6.00	78	78.00	6.	10.	36.	44.8
1.04	7.00	79	79.00	6.	10.	36.	44.8
1.04	8.00	80	80.00	5.	9.	35.	44.8
1.04	9.00	81	81.00	5.	9.	35.	44.7
1.04	10.00	82	82.00	5.	8.	35.	44.7
1.04	11.00	83	83.00	4.	7.	34.	44.7
1.04	12.00	84	84.00	4.	7.	34.	44.7
1.04	13.00	85	85.00	4.	7.	34.	44.7
1.04	14.00	86	86.00	4.	6.	34.	44.7
1.04	15.00	87	87.00	3.	6.	34.	44.7
1.04	16.00	88	88.00	3.	5.	33.	44.6
1.04	17.00	89	89.00	3.	5.	33.	44.6
1.04	18.00	90	90.00	3.	5.	33.	44.6
1.04	19.00	91	91.00	3.	4.	33.	44.6
1.04	20.00	92	92.00	2.	4.	33.	44.6
1.04	21.00	93	93.00	2.	4.	33.	44.6
1.04	22.00	94	94.00	2.	4.	32.	44.6
1.04	23.00	95	95.00	2.	3.	32.	44.6
1.05	0.00	96	96.00	2.	3.	32.	44.6

SUMMARY OF DAM SAFETY ANALYSIS

....	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	44.50	44.50	52.40
STORAGE	31.	31.	312.
OUTFLOW	0.	0.	3014.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	52.93	.53	344.	4218.	4.00	17.00	0.00

APPENDIX 5

Bibliography

1. "Recommended Guidelines for Safety Inspection of Dams," Department of the Army, Office of the Chief of Engineers, Washington, D. C. 20314.

2. Design of Small Dams, Second Edition, United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, 1973.

3. Holman, William W. and Jumikis, Alfreds R., Engineering Soil Survey of New Jersey, Report No. 19 Monmouth County, Rutgers University, New Brunswick, N. J. 1953.

4. "Geologic Map of New Jersey" prepared by J. Volney Lewis and Henry B. Kummel, dated 1910 - 1912.

5. Safety of Small Dams, Proceedings of the Engineering Foundation Conference, American Society of Civil Engineers, 1974.

6. Plans titled "Bridge No. U-11" (6 sheets), prepared by George K. Allen, Monmouth County Engineer, dated July 1923.